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The Pressure in Gas Mains.

The pressure of gas in the mains of New York is restricted within the narrow limits of 1 to 2½ in. of water by an act recently passed by the Legislature. The purpose of this restriction, as explained by those responsible for the passage of the act, was to prevent any extra pressure on the mains which the companies might see fit to adopt in order to force into the burners of the unwary consumers a very large and unnecessary amount of gas. This logic would be entirely satisfactory if it were based on a knowledge of the gas business acquired elsewhere than in legislative halls, where, it must be admitted, the pressure is sometimes needlessly high. Illuminating gas cannot be distributed by the same methods as the oratorical variety, however, and for this reason it seems likely that the Legislature at Albank has undertaken to bend the laws of nature by laws of man, a somewhat difficult proceeding. As a matter of fact it is impracticable to distribute gas satisfactorily in New York or any other large city when the pressures are restricted as proposed by this legislation. The leading authority on gas works management in this country, Mr. Alexander C. Humphreys, recently made the following statement on this subject: "For good service, the gas engineer must be sure that there is sufficient initial pressure at his several points of distribution to enable the mains to carry to the consumers farthest from these points a pressure sufficient to give a maximum efficiency with each and all of the many kinds of burners employed by the consuming public. An Argand burner requires less pressure than an open flat flame burner; the latter requires much less pressure than the incandescent burners, such as the Welsbach; some gas stoves, especially those for cooking, require even a higher pressure than the incandescent burners. The man does not live who is capable of operating any or all of the New York gas companies in compliance with the provisions of this law."

With the fluctuating demands for pressure along the same main, there is another consideration which is of much practical importance. It is the inclination of the manager of a gas plant to keep the pressure in the mains just as low as possible and still have most of his consumers satisfied. This is done to restrict the leakage of gas from the mains and thus increase the economy of the plant, and it has been Humphreys' experience that this tendency to keep pressure down is the most serious fault of the average manager, and not the contrary, as claimed by the advocates of the act recently passed at Albany. The statement made by these people that the pressure in the mains is raised so as to increase the amount of gas supplied to consumers is based on a misconception of the method of measurement employed in a gas meter. As a matter of fact, the only person who gains by a high pressure in the street mains is the consumer. He has at his disposal two means for reducing this to any amount satisfactory for his purposes; one of these is the meter cock and the other is the cock with which each burner is equipped. By these means it is practicable to regulate the pressure so that the best amount for the different classes of burners is obtained without any trouble whatever. On the other hand, the increase of pressure in the street mains brings to the manager of a gas plant a number of more or less troublesome problems, which he would much like to avoid, if possible, by keeping the pressure low. This brings up a thought The Engineering Record wishes to offer as a possible solution of some of the troubles that come with the rise of pressure on long gas lines. In electrical work the booster has been employed to keep up the potential on long feeder lines; in water works affairs a small auxiliary pump is sometimes installed to keep up the pressure on high-service or distant mains. These methods of keeping up pressure suggest the possibility of doing the same thing on long gas mains, using a blower driven by a gas engine at the end of one line in order to raise the pressure at the beginning of a second line connecting with the first. Gas engines are now so low in cost and so reliable in operation that their use for this purpose on the distribution system of a large gas plant does not seem to be expensive or impracticable.

Water Supply and Fire Protection.

If the recent convention of the American Waterworks Association did nothing else than take action on two important fire-protection subjects it would deserve to rank high in the record of useful technical gatherings of the year. Two of the most serious problems that have been facing the insurance interests and the waterworks managers during recent years are the detection of the use of water through fire protection lines running into manufacturing establishments and the standardization of threads on fire hydrants. Both these subjects have received a large amount of consideration for several years, particularly the latter, which has been the cause of considerable worry to fire chiefs, and up to the present time seemed to be as hopeless as at the outset of the movement for its solution.

A fire line running into a manufacturing establishment is put into place by a waterworks manager for one purpose, the assistance of the fire department. It is laid with the express understanding that it shall not be tapped for any kind of supply about the works other than that for which it is installed. Nevertheless the superintendent of the works of every city where considerable manufacturing is done has probably had an opportunity of observing that the fire protection lines are used surreptitiously for other purposes than that for which they are intended. This violation of the agreement under which the line is put into the plant is often made by some subordinate who does not know that his action is a breaking of a contract. He knows that the pipe is there, that its capacity is very large, and that it affords a handy source of supply to eke out a deficiency in some part of the works. Accordingly he taps the main and nobody is the wiser. After this has been done in a good many works the supply becomes unaccountably short and the waterworks superintendent makes an investigation, bringing to light a considerable number of such illegal connections.

In order to avoid any such condition the waterworks managers have been fighting for some years to install meters on such lines. In this fight they have been opposed by the engineers representing fire insurance interests. These engineers claimed that any object placed in such a line and tending to check the free flow of water reduces the utility of the line to such an extent that it should be recognized in the rate charged for insuring the property served by the line. This position of the insurance engineers has been vigorously opposed by the waterworks managers but it has at last been acknowledged by them to be a sound one. At the meeting of the Association last week, it was stated that on lines of this nature, which are supposed to be closed for months at a time, there is a tendency for sediment to collect in pipes just as it does in dead-ends. When a fire breaks out and the demand for a great amount of water comes suddenly, a large amount of sediment may be flushed into the meter, seriously interfering with its action and possibly choking the flow to such an amount that the line is of little use. This situation is a serious one, but fortunately it has been overcome by the joint investigations of committees of the National Fire Protection Association and the American Waterworks Association, which were ratified by the latter organization last week. As the matter now stands, any device can be inserted in a fire line which does not offer a resistance to flow greater than 6 per cent. of the head on the line and will leave the line free for a full discharge of water when it is demanded for fire protection needs. Already there have been brought out two devices answering this requirement, which will meter ordinary

flows through the fire line and also detect the passage of large quantities of water such as are required for fire streams. This much-disputed subject has thus been settled, so far as the clash of water and insurance interests are concerned, and has been sufficiently studied by inventors to show that it is capable of a satisfactory practical solution.

The threads on fire hydrants offer another subject of discussion which the recent meeting of the American Waterworks Association has done much to settle. There was a time when the designers of waterworks considered that they had not earned their fees until they had prepared designs for a new hydrant for each plant they were connected with. Sometimes the superintendents had ideas on the subject and also designed hydrants, and occasionally the fire chiefs were similarly afflicted. As a result there has come into existence an extraordinary variety of threads for hydrant nozzles, and it is these threads which cause trouble. It really matters very little from the fire-protection point of view what type of hydrant is used, provided it is tight, durable and obstructs the passage of water as little as possible. On the other hand, the threads on the nozzles are the features which determine whether or not the steamers in other cities can render assistance in case of serious conflagration beyond the capacity of the local equipment. As the matter now stands, it is impracticable for the steamers to be of full benefit except in the cities for which they are designed, because they cannot couple to the hydrants of other places. In consequence these borrowed steamers have to tie their suction pipes to hydrants as best they can or to draw water from the nearest open watercourse. The number of great conflagrations in recent years has proved the necessity of borrowing steamers from other cities occasionally, and consequently the standardization of the innumerable nozzle threads used in the past has become vital. The American Waterworks Association last week adopted a 7½ thread as its standard, a recommendation which is also satisfactory to the representatives of the National Fire Protection Association and the International Association of Fire Engineers. This thread is rather light, but it has the great merit of being suitable for cutting on a very large proportion of the nozzles now in use. Its adoption therefore means little expense for retapping in most cities, and will enable the fire equipment of one city to be as serviceable in another as in its own home. This is so desirable that the Association's action in the matter deserves wide recognition.

Indirect Damage Resulting from the Taking of Property for Public Water Supplies.

The public of New York City has heard much of the question of indirect damages in connection with its system of proposed additional water supply, and a large portion of the public outside of the city has been greatly interested in the endeavor to impose upon it by appropriate legislation the obligation to meet such damages. When it was proposed last year to take water for the city of New York from Fishkill and Wappinger creeks, the so-called Smith bill was enacted into law, largely in consequence of the apprehension that the city would evade the payment of indirect damages in case its water supply should be extended so as to reach those two streams. The session of the State Legislature just closed has been the scene of determined efforts to secure the same class of excluding enactments for other portions of the State available for additions to the present water supply of the city, mainly on the ground that the city was supposed to be opposed to the payment of indirect damages. After much agitation and many material amendments to the original bills legislation has at last been secured under which the city may construct a system of additional gravity supply by taking the waters of the Catskill region or from other sources not expressly excluded by other legislation. This taking of water, however, can only be accomplished after submission of maps and general plans for approval by a State Commission created by concurrent legislation of the session just closed.

Approval of a source of water supply by a State Commission, prior to its taking by a city of the State of New York is a new legislative requirement, and one of its significant features is the recognition of claims for indirect damages. This principle, as stated in the new law, is clearly applicable to real property, but there may be question whether the provisions of the act creating the State Commission justify the application of the principle to business or other industrial enterprises. It is well known to those who have been familiar with the arguments made before the Governor and legislative committees that a number of Ulster County interests opposed the passage of any act permitting the city of New York to take the water of Esopus Creek on the ground that the indirect damages to certain lines of business now established there would be great, and that nothing less than the full recognition of such claims would justify the legislation desired by the city. Although other classes of objections were urged in behalf of other localities, the broad principle of indirect damages has probably never before been so generally and so determinedly advanced.

The rapid growth of population in all quarters of the State and perhaps a greater extension, even, of business interests more or less affected by streams available for public water supplies, have brought about conditions which make the taking of water from them a matter of much greater moment than ever before. The abstraction of a substantial portion of the flow of a stream means generally a daily draught far in excess of the ordinary discharge during the relatively dry months of the year, necessitating the construction of large storage reservoirs for the accumulation of the surplus flood waters.

It so happens that the proposed great Ashokan reservoir on Esopus creek covers an area of about 9.5 square miles, which is a considerable percentage of the arable land in that part of the Esopus valley, and it includes several small villages. Within its flow line also lies about ten miles of the track of the Ulster & Delaware Railroad. This combination of business and physical features affected by the construction of this reservoir is calculated to raise in a well-defined manner, and most seriously, questions of both direct and indirect damages, which will doubtless have to be met in completing an additional water supply for the city of New York, drawn from Esopus creek. The details of such questions manifestly cannot be discussed with profit at this time, if at all, but the treatment of the general principles involved may be illuminated not only by the general consideration of what is just and fair under such circumstances, but also by what has been done elsewhere.

It certainly is obvious that an established business may be injured by the removal or direct destruction of other interests for which fair compensation has been paid to owners. In other words, the taking of water rights, land or other real property under direct compensation may so radically change the conditions on which the business interests of an adjoining community depend, as materially to decrease or even destroy that business. In the same manner the necessary relocation of a portion of a railroad line may materially prejudice the business of the portion so relocated. The necessity of recognizing such general principles is probably obvious enough to anyone, but the difficulty lies in their application. If the source or sources of the business indirectly affected are simply moved to a comparatively near but new location, the point is to determine how much and in which direction the interests in question are affected. If it can be shown that a real loss has been inflicted, corresponding compensation should be made. At the same time, if it could be shown that the complaining parties were benefited, they would undoubtedly resist an assessment of corresponding character. There are so many contingent and complicated elements in all cases of this kind that the principle of indirect damages, even if accepted in the broadest sense, means far less than would be supposed at first sight. Such cases are not new, and wherever they have been carried into court it has been so difficult to prove the losses claimed that the awards have generally been disappointingly small to those who have made the claims.

Whether the provisions of the recently enacted laws under which New York City's additional water supply system will be constructed are such as to permit claims for indirect damages to business interests or not, such claims will undoubtedly be made and resolutely pressed in the courts. Similar experiences in other quarters, however, appear to indicate beyond a doubt that the resulting awards can never be large enough to be very formidable or to justify any alarming apprehension as to their magnitude.

There is full recognition of the broad and general principles of indirect damages in the Massachusetts law creating the Metropolitan Water Board and in subsequent legislation affecting that board about as clearly expressed as any aggrieved party could desire. Yet in all the cases which have arisen under those enactments the difficulties of proof have been so great that the awards have been small. These questions are of the utmost importance as they have a real basis, and cannot be evaded. It is, therefore, at least good public policy to meet them fairly, and reach by court decisions their established character and magnitude.

Compactness in Power Plant Design.

Although the elements which enter into the design of the modern power plant usually are sufficiently diverse to require a number of compromises in the final layout, it frequently happens that undue importance is laid upon some particular feature of the work, with the result that the economic operation of the plant as a whole suffers. A frequent instance of this is found in office building propositions where expensive steam and electrical machinery is jumbled together in a dark and dingy sub-basement corner in which floor space is at a premium, fresh air a scarce commodity, waste heat plentiful and proper maintenance an elusive ideal. Now there is nothing wrong with the sub-basement per se as a location for a properly designed plant, but in the quest for compactness of design, which of late has been the watchword of much work, the centralization of machinery has often been carried to an excess that cramps the convenient operation of the entire plant.

There is no doubt that in many cases that fall within scope of city practice compactness in design is an exceedingly important result to secure, and where the cost of land is high there is generally no alternative but to figure the disposition of machinery down to the last square foot consistent with accessibility for repairs and inspection. But the problem of packing engines, boilers, pumps and generators into a limited

space on land is a very different question from the arrangement of the same character of equipment on shipboard, and it ought to be realized that the conditions which surround the stoke-hole of a modern ocean liner have little excuse for repetition on shore. In one of the prominent hotel plants in Washington, for example, the attempt to secure excessive compactness has resulted in an installation where repairs to the piping could be carried out only with exasperating difficulty and delay; an engine room habitable only to the wearers of scanty clothing, and in general a working place of undesirable surroundings and internal discomfort. It is scarcely a surprise that the plant bears the marks of rapid depreciation and shows at a glance how seriously the operators are handicapped in their efforts to keep the equipment in good condition.

If it is possible to err on the score of too compact a design, it is also not difficult to swing too far in the other direction and install a layout so scattered as to be unduly expensive in real estate charges and too large for the effective oversight of a normal number of employees. A case in point is found in one of the latest office buildings in Baltimore. Here the boilers are located in one section of the sub-basement, the pumps and engines being scattered about all through the balance of the premises, between brick pillars and beneath a low ceiling in such a way as to require the services of an extra engineer for proper oversight, besides keeping the rest of the force constantly on their feet with little opportunity to rest.

As a matter of fact, it is rarely necessary to allow space enough between machines in an isolated plant to pass through with great ease the largest pieces of machinery on the premises, for the reason that the bulk of repairs in such installations can be executed on the spot without the removal of heavy parts from the engine room. When a plant becomes large enough to require the use of a hand or power driven traveling crane, the importance of liberal space becomes greater. What is necessary is to forecast as far as possible the probable character of repairs to be made and then to allow sufficient room for their execution. Such an allowance is pretty sure to provide for operating convenience, but it is well to bear in mind the question of personal safety in such matters as aisles between flywheels and walls, etc. Compactness is desirable if not carried to extremes, but it is often worth figuring whether the cost of additional real estate is really offset by the space economy of concentrated power units. Isolated plant designs to-day exhibit a vast range of both able and inferior work and it is important to balance up a good many considerations in settling upon final plans.

Notes and Comments.

An Engineering Congress will be held at the Lewis and Clark Centennial Exposition at Portland, Ore., on June 29 to July 1, inclusive, to which all engineers, architects and technical men are invited. A number of papers have been promised by members of the Pacific Northwest Society of Engineers, the Technical Society of the Pacific Coast, the Corps of Engineers of the U. S. Army, and the Reclamation Service of the U. S. Geological Survey. Arrangements have been made for excursions to the many interesting engineering works in the vicinity of Portland, and the railroads have agreed to make low rates for those attending the congress.

A Marl-Gravel Road near Greensboro, Md., is a curiosity in its way. About 15 years ago a quantity of gravel and marl was dredged from a river and put on a road where it has hardened under traffic into a mass resembling the coquina of Florida. Mr. A. N. Johnson, formerly highway engineer of Maryland, states that the gravel ranges from ⅛ to ¾ in. in size and is mostly quartz, the small pieces being very sharp. The marl acts as a binder, holding in place the gravel, which sustains the wear that comes on the surface. No ordinary shell road would have stood a quarter of the wear. Apparently there is enough of this material in the river bed to make several miles of road, and the advisability of using it depends on the cost of dredging it. The vicinity is entirely without other road-building materials.

The Diversion of Water to supply a city not located within the watershed of the stream has recently been declared illegal by the California Supreme Court. In So. Cal. Inv. Co. v. Wilshire, the court has ruled, 77 Pac. Rep. 767, as follows: "Where the owner of a prescriptive right to the use of all the surface waters of a stream for irrigation and domestic purposes attempts to sell the right to a city, necessitating the piping of the water beyond the watershed of the stream, the owner of a riparian right in the stream is entitled to enjoin such use without proof of damages; it appearing that, by permitting the water to flow in the usual way, some of it would seep into and percolate through the soil and again reach the stream, to the benefit of the riparian owner." Although this decision is novel so far as it relates to underflow, it is the same in principle as several that have been made in Eastern States and mentioned in this journal.

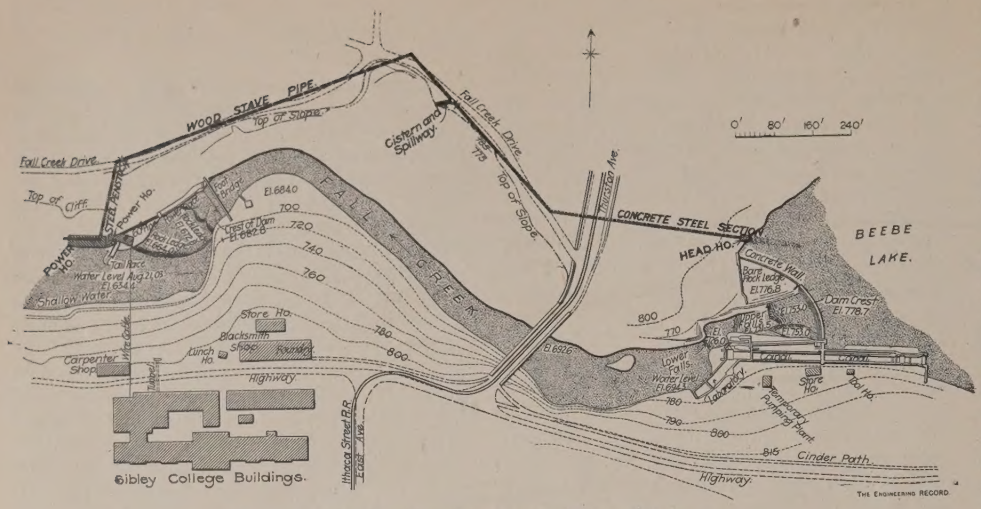
The Heavy Tornado that occurred last month at Laredo was particularly interesting to engineers for its effect on the highway bridge across the Rio Grande. This structure was blown off its supports in a manner described elsewhere in this issue, but a railway bridge not far away was uninjured. In one of the views illustrating the article referred to there is a photograph of the Laredo water tower, still standing in the midst of the wreckage about it. An old chimney at the pumping station was blown across the boiler room, disabling the plant for a number of hours, but the tower, which is generally considered the part of a water plant most vulnerable to the action of a cyclone, was uninjured. This structure was designed by Mr. Edward Flad and described in this journal on March 9, 1894. It attracted much attention at the time it was built for its unusually heavy construction, the value of which was well proved by its resistance to the tornado of last month.

The Reservoir Failure at Madrid last month was a terribly fatal affair, which will unquestionably affect the standing of reinforced concrete construction in Spain. The reservoir was a covered structure, 357x204 meters in plan, divided into four compartments. There were 3,080 columns about 9 meters high supporting the roof, and these columns were 25 centimeters square. The arches were 5 centimeters thick and had clear spans of 6 meters. Part of the work was being executed by private contract and the remainder by the government. The columns were connected at the top by parallel rows of very light reinforced concrete beams which carried the flat barrel arches. The work was nearly completed when the accident occurred, the whole roof falling upon the workmen below. The destruction was complete. Photographs of the ruins show that the adhesion of the concrete to the metal reinforcement was too slight to amount to anything. The concrete of the roof broke up into small pieces, although many of the columns and beams proved of better quality. The foundations of some of the columns seem to have been placed on poor soil, although definite statements to that effect have not yet been made by engineeers.

Promoting Enterprises requires considerable more ability than is apparently possessed by the men behind a Kansas railway project. They have been advertising for an engineer for some time, but not solely for engineering purposes. One applicant was informed that he had been selected from among several other candidates, but to secure the place would have to put up several thousand dollars in cash. Afterward the amount was cut down to $2,000, but this engineer did not care to invest and assumed that some of the other candidates would be selected. Apparently, however, they were not, for the advertisement has since appeared in other publications. Just where the idea originated that engineers care to do business in this way would be difficult to say. Railway location engineers of much experience have generally had opportunities to contribute their services to budding companies without other pay than stock certificates, but a request for cash subscriptions implies a belief in the wealth of the profession which is as flattering as it is untrue.

The Follow-Up System of keeping in touch with possible business connections is employed for such a great variety of purposes that the following suggestions concerning it deserve careful attention. They were made by Mr. Arthur Warren, manager of publicity of the Allis-Chalmers Co., at the recent annual dinner of the Manufacturers' Advertising Club, of Cleveland. "Most follow-up systems," his experience has been, "are too complicated; they entail too much clerical labor. A follow-up system that produces results without complexity is a good trade-getter. But it must be adapted to the special needs of a business. The reason so many systems break down is because they are imitations of what other people do. No system is effective without brains behind it. You must not only follow up your public, but you must follow up your system." Coming from one with the experience in such matters that Mr. Warren possesses this advice is particularly valuable, and indirectly points out the desirability of carefully testing any such system before definitely adopting it.

Comparative Locomotive Tests on the New York Central experimental track near Schenectady were made on April 29 with the electric locomotive of the 6000 type, described in this journal on November 19, 1904, and a Pacific type steam locomotive. The latter was about 67½ ft. long and weighed 342,000 lb.; the electric locomotive was 37 ft. long and weighed 200,500 lb. The track was 6 miles long, laid with 80-lb. rail, and was in good condition. On account of the restricted cross-section of the conductors, the voltage of the electric locomotive dropped considerably lower during acceleration than it will in actual practice within the New York Central's electric zone near New York. Consequently, the results obtained with the electric locomotive are much less favorable than those to be expected in actual practice. Six runs in all were made, but the most important was one with six-car trains, in which the electrical conditions were closer to those of practical conditions than the others. On these runs the electric locomotive, hauling a revenue-bearing load of 307¼ tons, reached a speed of 50 miles per hour in 127 seconds, while the Pacific type locomotive, hauling 256 tons of revenue-bearing load, required 207 seconds to attain this speed. On the other runs the electric locomotive did not surpass the steam locomotive in speed until runs of 1 to 2 miles had been made, although it overtook and passed it in every case before the power was shut off.



Map of the Dam and Water Rights within the University Grounds

THE NEW HYDRO-ELECTRIC POWER PLANT OF CORNELL UNIVERSITY.

By W. W. Churchill.

Within the past few months there has been constructed and placed in operation at Cornell University a hydro-electric generating station, which, though of rather moderate size, has several points of interest.

Ithaca, N. Y., the seat of Cornell University, is situated at the southern end of Lake Cayuga in a country of peculiar formation. The surrounding country rises rather abruptly from the shores of the lake for about 400 ft. until a rolling upland is reached, while the general trend of the country back of this is to further rise rather gradually until in the course of a few miles elevations of from 1,500 to 1,900 ft. above sea level are common. At ordinary stages the surface of the water in the lake is about 381 ft. above sea level. The drainage from the watershed thus formed flows to the lake in rapid streams, which in many places along the shores of the lake plunge the last few hundred feet in cascades formed by rock ledges between the precipitous sides of deep, rocky gorges.

Most of these streams have a rather limited watershed, and while they furnish an ample head of water, the low-water flow is scant and uncertain. One of the largest of these streams is Fall Creek, which, with a watershed of 147.5 sq. miles in Tompkins and Cortland Counties, passes through the campus of Cornell University in a beautiful gorge, step after step of its downward course being in beautiful cascades set between almost perpendicular walls of rock. Just where this stream enters the university property the valley takes a form favorable to an impounding reservoir and at this point, which is called Trip Hammer Falls, the university has constructed a pumping plant for supplying the university with water, an hydraulic laboratory for instruction and investigation, and a concrete dam for controlling the stream. The impounding capacity of this dam is 5,000,000 cu. ft. and its construction having been warranted by other reasons, its cost is not a proper charge on the power generating equipment, which is here referred to. Between the level of the surface of the water in this pond, or Beebe Lake as it is called, and that of the stream at its lowest point within the control of the university the fall is 145 ft.

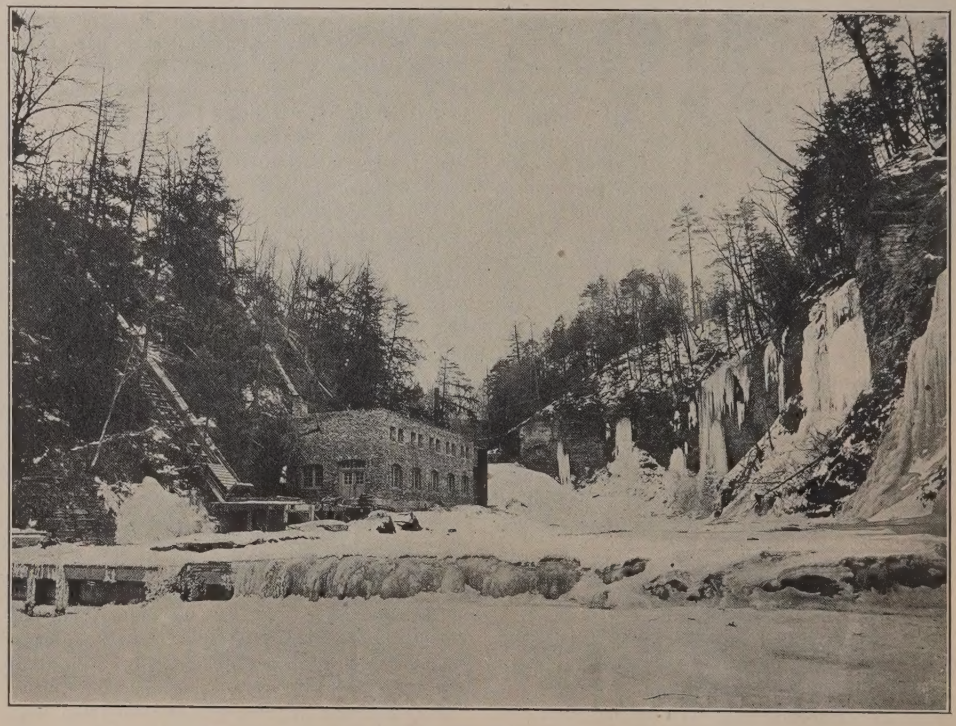
The possession of this power right and the necessity of providing additional power capacity to meet the growing requirements of the university, caused the university authorities to begin a study of probable low-water capacities of the stream and the cost of a suitable hydro-electric generating plant capable of utilizing the opportunity should there be found water enough to warrant the expenditure. Accordingly the trustees of the university appointed a power committee, consisting of Messrs. Walter C. Kerr and Frank S. Washburn, with authority to actively undertake the investigation and, if considered wise, the construction of the electrical power generating plant.

The purposes for which the power was desired were, briefly: Lighting, ventilating, operation of shops and supply of laboratories. It was foreseen that the laboratories would require especially good voltage regulation, while the character of some of the other loadings would be such as to render close regulation difficult to attain, so that great care in the planning of the controlling apparatus was demanded. The necessity for an increase in the power supply for the university had existed for some time, and for several seasons current was purchased from generating plants in Ithaca to meet the requirements. During this time, however, the characteristics of the watershed and the rates of flow of Fall Creek at Trip Hammer Falls were being carefully investigated.

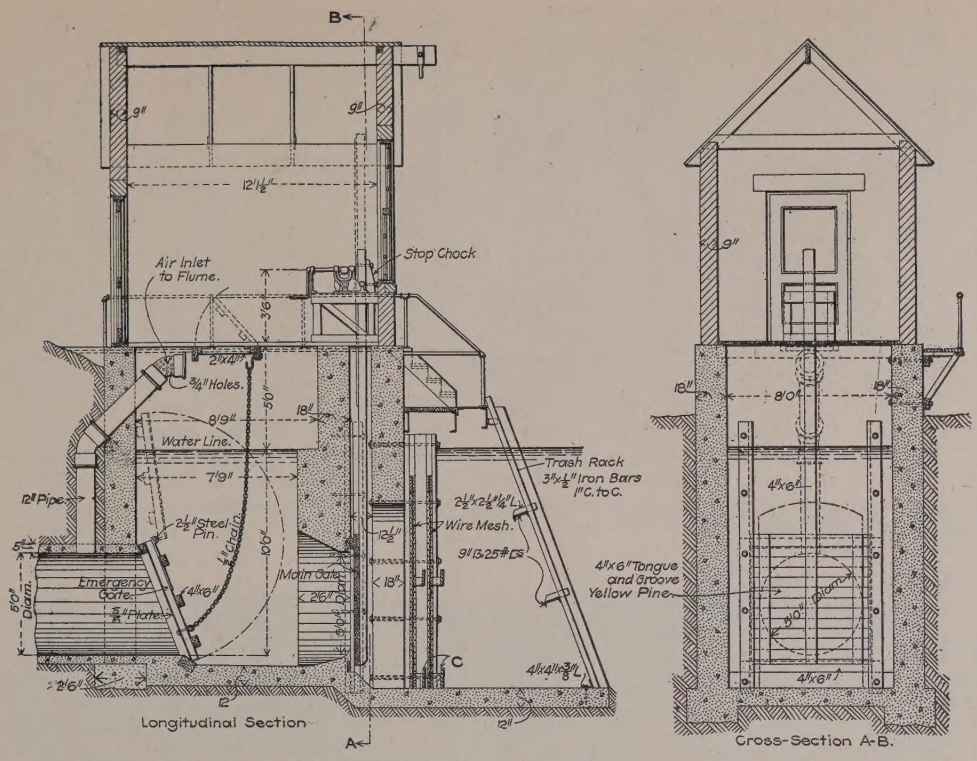
It was found that the watershed contained approximately 147.5 sq. miles and that it was of such a nature that precipitation ran off quickly, indicating that great care must be taken in the study of the minimum flow and consequent low-water capacity. Gaugings were made at the dam at Trip Hammer Falls by the late Professor Fuertes, who found that the minimum flow of Fall Creek in extremely dry weather was 12 cu. ft. per second; that the flow of the stream in ordinary dry weather was 46.8 cu. ft. per second; that the average flow throughout the year was 175 cu. ft. per second, and that the maximum flood discharge was 4,800 cu. ft. per second. During the year 1897, gauging of the stream showed that the lowest rate noted by weeks was an average flow of 30 cu. ft. per second. Though the month of October, 1897, was the driest in eighteen years, the average quantity of water flowing during two weeks of gauging in that month was 45 cu. ft. per second. The minimum run off of .0813 cu. ft. per sq. mile per second is very small.

It was found that after making proper allowance for the university water-works plant at Trip Hammer Falls there would be left in the driest season 883,400 cu. ft. of water per day under a net available head of 145 ft. From this amount and on acount of the characteristics of the university load, it was seen to be necessary to waste, during the period of 6 A. M. and 9 A. M., about 72,000 cu. ft. to enable the starting of the mills on the powers below. After deducting these quantities it was found that with an efficiency of 60 per cent. as measured at the motor shafts delivering power at the university, the entire power requirements of the university as they appeared on Oct. 12, 1900, would be met at low water without any allowance for storage or impounding and leave an additional 566 e.h.p. hours available each day for additional service at any hour it might be desired to draw water from the pond for its generation.

The cascades in the stream, where under university control, are at two principal places so far



The Completed Power House in the Gorge opposite Sibley College Buildings.



Details of the Headhouse of the Conduit at Beebe Lake.

apart, some 1,500 ft., as to materially increase the expense of construction by necessitating either two plants or a single plant with a long supply conduit. Designs and estimates were made for two plants, each using part of the fall and compared with the plans and estimates of a suitable single generating plant with the more expensive conduit. The probable annual cost of operation, including all fixed charges and repairs, was found to be less for the single plant than for the two plants, and it was decided to spend the larger sum required to develop the power at one point.

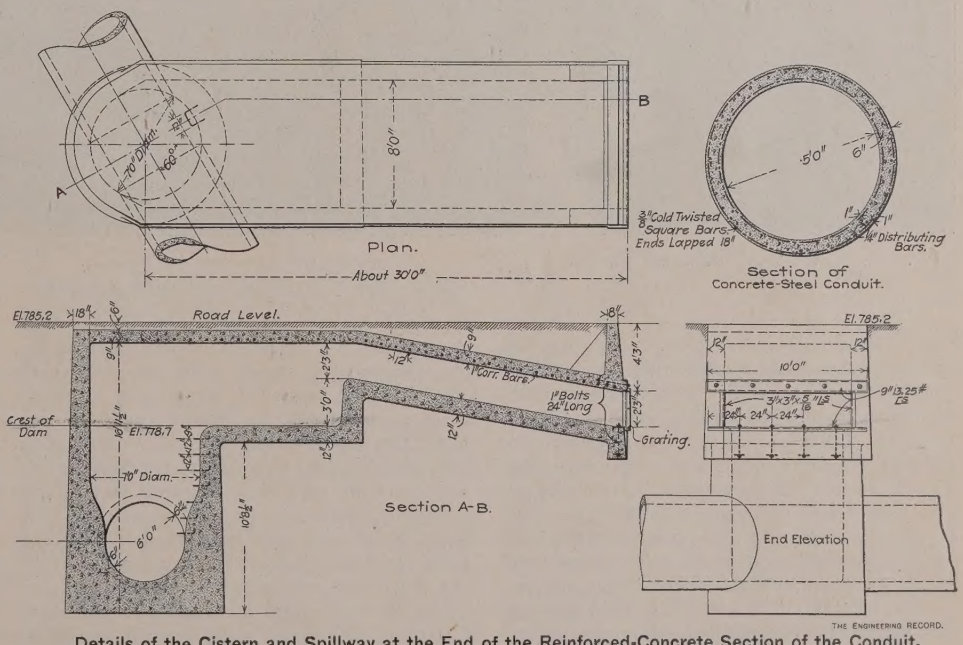
When the engineers who executed the work began to take an active interest in the design and construction of the plant in 1901, there existed the dam and flowage rights at the Trip Hammer or Beebe Lake which, being available without annual charges, would make it possible for a water power plant to produce the power then required by the university at a lower cost than the same quantity could be generated by steam under conditions at Ithaca, and that such a water power plant would further be able to produce comparatively large quantities of power at certain times of the year for no additional charge, this making it possible to use current in large quantities for testing and experimental work without additional capital or operating charges since reserve equipment could be used for this purpose during the portion of the year when there is a plentiful supply of water.

The original plans contemplated a 48-in. steel pipe running along the bottom of the gorge. This had an advantage of economy, but without a standpipe which was not permissible it would subject the machinery to shocks fatal to good regulation. An exposed 48-in. flume in the bottom of the gorge was furthermore not desired since it would mar the natural beauty of the forge. It was therefore determined to locate the conduit on the high land alongside of the gorge and to so design it that the water would flow for as much of the distance as the general slope of the land would permit in either an open channel or its equivalent.

Careful surveys, involving levels, alignments and examination into the characteristics of the material to be excavated were made on both sides of the gorge. It was desired, if possible, to place the power house on the south, or Sibley College side, of the creek, to avoid crossing of the gorge with unsightly wires, as well as to be nearer to the work to be performed. The only feasible location of conduit on the south side was found to involve considerable extra rock tunneling while the southern cliffs overhanging the point where the power house must have been located gave evidence of insecurity.

The north side location for both conduit and power house was found to have many advantages and was adopted. The length of the conduit as measured from the head gate to the point where it enters the power house is 1,766 ft. The gate house is in very shallow water and a channel gives a suitable connection at low water. The conduit is 60 in. in internal diameter and, from the character of construction, divides into three sections. The first section is of reinforced concrete-steel 1,036 ft. in length; the second section of 450 ft. is of California redwood and the third section of 200 ft., which leads down from the cliff to the power house, is of riveted steel.

The concrete-steel section was used where it was necessary to drift and shore so as not to disturb the surface of the ground, as well as where the open ditch was to be of considerable depth, imposing heavy loadings of backfilling. The concrete section is not subject to much internal pressure and is protected from shock by terminating in an overflow tank or cistern so designed as to obviate the shock due to action of governors or the closing of blow-off valves. This cistern was made of a generous size with the spillway from it so arranged as not to waste water at time of low stage in the lake. The water rising and falling in the cistern as the quantity passing it is decreased or increased, the overflow acts as a safeguard against shock to the concrete work at times of high water. The details of this spillway are shown in an accompanying drawing.



Details of the Cistern and Spillway at the End of the Reinforced-Concrete Section of the Conduit.

Beyond this spillway the slope of the ground was such as to put the conduit under pressure and to meet this condition the conduit is of California redwood staves 2½ in. thick, securely held in place by mild steel bands ⅝ in. in diameter on an average of 8 in. centers. The redwood pipe was preferred for this section as better calculated

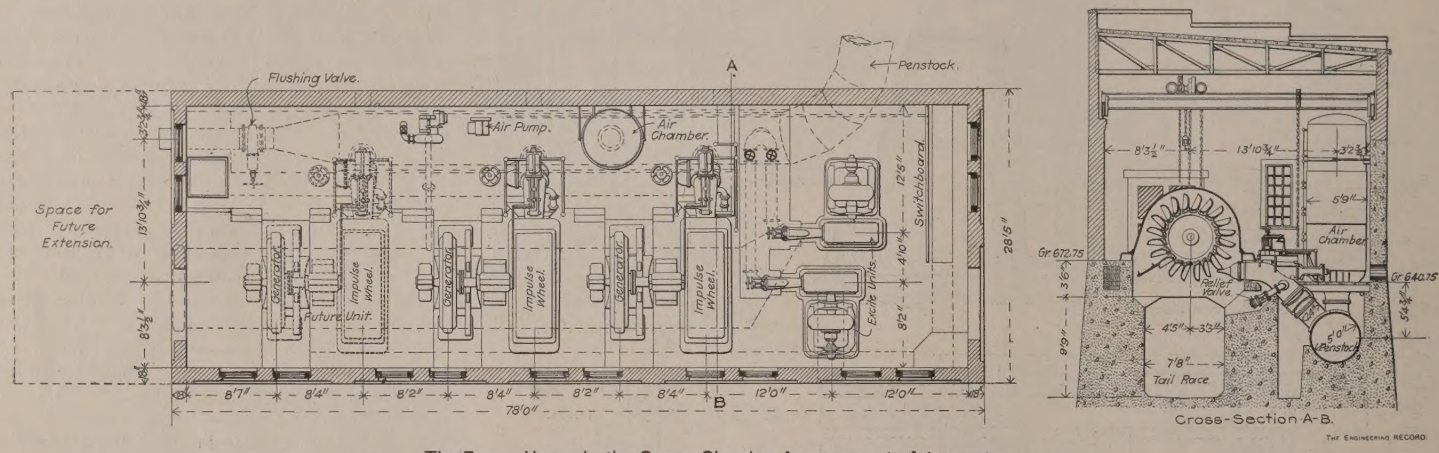
to withstand pressure and shock than the concrete construction and less liable to deterioration and rust than riveted steel. The redwood pipe extends to a point nearly abreast of the power house and there connects to the steel pipe 200 ft. in length, which passes diagonally downward to the power house through a rock tunnel. The steel pipe is of generous thickness and after being put in place was grouted with concrete to preserve it from external corrosion.

The illustrations show the character of these several sections of conduits, while a drawing shows the arangement of the intake or gate house at Beebe Lake. The foundations and walls of this gate house are of concrete, the roof of tile on wooden framing. As the water approaches the gate house it first passes through a heavy stream above Beebe Lake shell considerable corn and throw the cobs into the creek. These cobs become waterlogged, neither floating on the surface nor lodging on the bottom and are very troublesome, as they seem to dodge through any workable set of screens that can be devised. They are especially annoying where they have to pass through nozzles or wheel gates, especially at light loads, and it is hoped that their general tendency to bump along near the botom of the pipe, in conjunction with the locations of the branch openings to the wheels, will enable many of them to be blown through this gate and prevent most, if not all, the troubles which have been experienced in turbine gates along the stream.

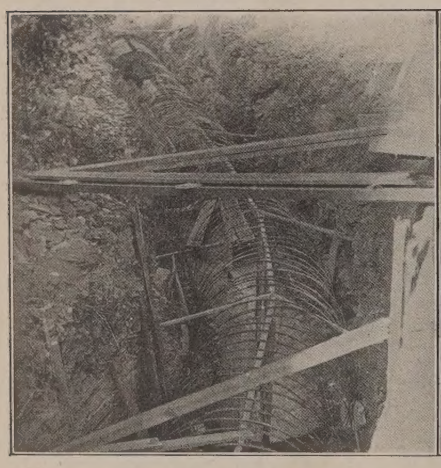
The power plant building, which is shown in plan and section, is 28 ft. 5 in. x 78 ft. out to out. Its foundation is of heavy concrete construction, the tailraces being formed in the mass. The walls are of Roman masonry, using stone from the gorge to harmonize the building with the surroundings, and the roof of steel and concrete. The complicated mass shown overhead in the interior is the supporting structure for the concrete roof construction and will be removed. The floors are also of steel and concrete. All power wires are run in vitrified clay ducts, and all details are of the most substantial construction.

The penstock enters the building at the upper cliff corner and passes along the cliff side of the house with short direct branches to the main units whose shafts are parallel to the center line of the penstock. There was much objection to the location of a standpipe on Cornell Heights and since such an affair would disfigure the gorge if placed there, a large air chamber or tank placed above the penstock in the power house, was resorted to, as shown in the section; this was located in close proximity to the wheels to prevent shocks and to facilitate the speed regulation of the wheels. The air space is maintained against leaks by the occasional operation of a Westinghouse traction brake pump wound for 125 volts and using exciter current. Under present conditions this pump maintains the air space in the tank by operating a few minutes at intervals of several days.

Sufficient space to accommodate a third 150-kw. main generator was provided in the power house, while the university property line, toward the west from the power house, is so situated as to permit an extension of the power house for a fourth 150-kw. unit. The conduit from the lake is sufficient to serve all four machines when installed. The building is warmed by a substantial steam heating installation.

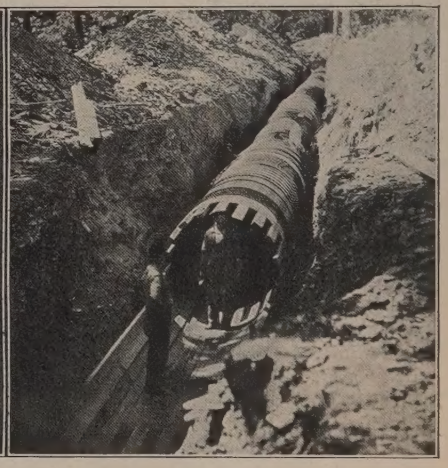


The Power House in the Gorge, Showing Arrangement of Apparatus.



The Flume Section of Reinforced Concrete.

Connection with the Vertical Steel Penstock.



The Wood-Stave Section under Pressure.

Construction Views on the Hydraulic Conduit Line.

trash rack of ½x3-in. iron bars placed 1 in. apart, and so arranged that trash can be raked the full length of the bars on to a platform 24 in. above high water and easily accessible from handrailed runways. Inside of this rack are two vertically sliding racks of 2½-in. mesh to catch hay or other fibrous material passing the first barrier; the second screen is to cover the inlet when the outer is up. The areas are made large and the inner racks carry baskets to raise trash as it peels off the mesh in elevating the screen. The gate-controlling apparatus is located inside the house; the first gate slides vertically and slowly, and the second or hinged gate is for emergency use. A 12-in. air pipe connecting with the conduit, prevents possible collapse of parts by vacuum in case of closure of the emergency gate.

A 24-in. Chapman flushing valve has been placed at the downstream end of the conduit in the power house. This was considered especially desirable because the small country mills situated on the

The selection of the type and character of the main generating unit was made with especial regard to high efficiency at low water. The head of 145 ft. introducing a likelihood of very low average operating efficiency for turbines, especially at partial loads, it was decided that the more expensive impulse type of wheel should be used. The selection of the highest type of construction was facilitated by the willingness of several manufacturers to make substantial concessions due to special regard for the university and the highest type of design and construction became available.

Each main generating unit rates at 150 kw. and is operated by an impulse wheel rating 280 h.p. at the head available. The speed of rotation is 124 r.p.m. and the driving jet is 7 in. in diameter under a pressure of 56 lb. per sq. in. The floor space occupied by each unit is 14 ft. wide and 21 ft. long. The top of the wheel case is 9 ft. above the operating floor.

The wheels are of the Abner Doble Co. design

and are mounted on the overhanging ends of the two-bearing shafts, the electric generator being placed between the two bearings of the unit. The shafts were made of large size and special material to insure rigidity and are 10 in. in diameter at points of maximum strain; they are hollow-forged, oil-tempered, 3½ per cent. nickel steel. The main bearing upon which most of the load of the unit is imposed is 10 in. x 36 in., while the outboard or tail bearing is 7 in. x 17⅜ in. Oil rings to protect the generators are machined out of the original forging as part of the solid shaft. The main bearings are provided with water circulation for emergency conditions and both bearings are self-oiling with shells designed to permit their removal without disturbing the shaft.

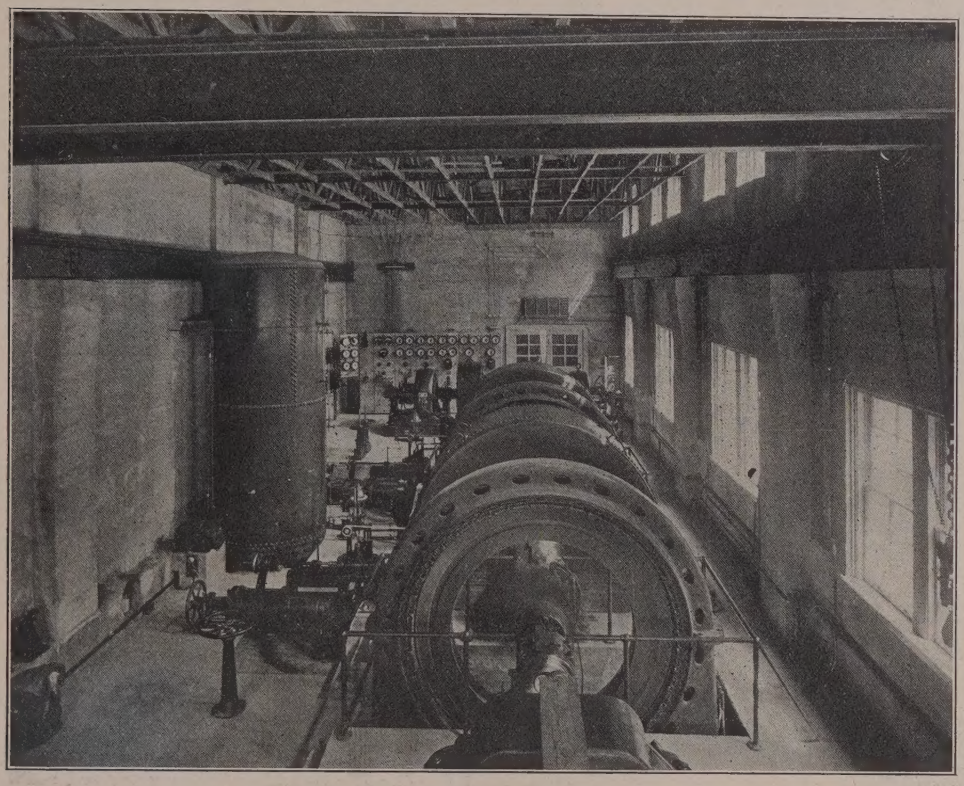
The wheel bodies are of cast iron in disk form accurately balanced and of a diameter of 8 ft. 6½ in. and are bolted to the heavy forged flanged end of the main shaft. The wheel disk is machined to accurately fit over a projection 10 in. in diameter upon the face of the shaft flange and the disk and shaft are bolted together by eight tapered bolts in reamed holes. The buckets are of brass of the Doble ellipsoidal type with water surfaces polished. The general design and construction is such that the splitters or dividing edges travel in the same plane and can be so maintained.

The nozzles are of the Doble type in which the regulating is effected by a moving needle or core which travels along the axis of the nozzle in response to the governor. The acceleration of the water takes place at the nozzle for all quantities flowing. The inlets of the nozzles of the main units are 24 in. in diameter and the supply of water is controlled by a 24-in. Chapman valve placed below the floor with spindle horizontal and operated through a bevel gear and floor stand. All parts of the regulating apparatus of the nozzles are above the floor and readily accessible.

The governors are Lombard type M and are located on brackets on the top of the nozzles. They are connected by a system of levers to the above-mentioned regulating needle. These connections are so arranged that they can be readily disconnected to permit passing to hand control quickly. Five-inch Lombard balanced relief valves are provided on each generating unit as a precaution against excessive pressure due to too sudden stoppage of the flow from any cause.

The nozzles, buckets and other special parts of the wheels were made by the Abner Doble Co., of San Francisco; the other parts of the wheels, except the shafts, by the Wellman-Seaver-Morgan Co., of Cleveland, O., in accordance with drawings prepared by the Abner Doble Co. The shafts were made by the Bethlehem Steel Co.

The generators are of the rotating field type and were furnished by the Westinghouse Electric & Mfg. Co. These machines generate three-phase current at 2,200 volts and 7,200 alternations and are so proportioned that the temperature of the armature and fields shall not exceed 40° Cent. rise above the temperature of the surrounding atmosphere at rated load and 50° rise with an overload of 50 per cent. for a period of one hour. The exciter units are each of 30 kw. capacity and are similar to the main units. They are right and left-handed, respectively, and discharge into separate tailraces, enabling the separation of the exciter test from the generator test when desired.



Interior View in the Power House, Looking toward the Switchboard.

The parts of these machines are of generous size and are assembled upon a substantial base plate to insure alignment. The shafts are 3¾ in. in diameter. The exciter wheels are under hand control and are made of 30 kw. capacity in order to provide current for lecture room lamps at the university. The exciter generators were also made by the Westinghouse Electric & Mfg. Co. and are wound for 125 volts.

The switchboard, also supplied by the Westinghouse Electric & Mfg. Co., is a model of switchboard construction. It consists of two exciter panels, two generator panels and one load panel and proper provision has been made to receive future panels for additional generating units as well as for a future breakdown panel for a circuit from some other generating station.

The main generating units are probably the best hydro-electric generators of their size ever constructed. The engineers, Westinghouse, Church, Kerr & Co., have had the fullest co-operation of the Abner Doble Co., who made the shop drawings for the wheels and actually constructed the nozzles and buckets; of the Wellman-Seaver-Morgan Co., who built the wheels and their cases; of the Westinghouse Electric & Mfg. Co., who built the generators and assembled the revolving elements; of the Bethlehem Steel Co., who forged and finished the shafts, as well as the Lombard Governor Co. and the Chapman Valve Co., who furnished the governors and stop valves.

The plant has been in operation since the first of the year, and although certain necessary changes in the electrical distribution system of the university have not been completed, current for lighting is being distributed through the old system of wiring by means of a motor-generator. It is interesting to note that the character of the regulation of the main units has proven to be very satisfactory and suitable for the laboratory requirements at Sibley College.

The entire plant was designed and its construction directed by Westinghouse, Church, Kerr & Co., without charge, and a number of the graduates of Cornell connected with the engineers and engaged on the work took great pleasure in giving much of the required attention outside of business hours and on holidays. The field work was in charge of Mr. E. C. Sickles. As for the writer, it was a great pleasure and privilege to direct the designing and construction of what was not only likely to be of service to the university, but which was to be the realization of one of his undergraduate dreams.

Stoney Sluices at the Headworks of the Ontario Power Co.

The first of the Stoney sluices at the headworks of the Ontario Power Co., Niagara Falls, has been set in place. This sluice or gate is 18 ft. square, and operates under a head of 35 ft. between water level and sill. The construction is such that the gate does not extend above the water level, but closes the entrance to an 18-ft. conduit, the top of which is 17 ft. below water level. The 18-ft. conduit is the first of three to supply water for the development of 200,000 h.p.; the second and third will be 20 ft. in diameter, and will have sluices 20 ft. square. These works have been fully described in this journal.

The Stoney sluice is so constructed that the gate hangs freely between the abutments, which are recessed. Instead of the gate fitting tightly against the face, as in the common sluice, the gate bears on a set of rollers which are carried in a frame and are free to move up and down. The rollers travel only half the distance of the gate, and the pressure of the gate against the face is taken up through the rollers and not by the journal of the roller. A rolling contact, therefore, and not a sliding contact with excessive friction, is made between gate and abutment, the friction being reduced to such an extent that only a 5-h.p. motor is required to raise the gate in three minutes.

Since the gate hangs freely between abutments and is entirely immersed, special means are required for making it water-tight. This consists of adjustable strips, carefully planed and bolted to the gate, which fit accurately to similarly planed surfaces on the abutments, sill and lintel. The gate was set up and riveted together in place, after which the adjustable strips for making the sluice tight were set to an accurate fit with the very carefully plumbed abutments, and carefully leveled sill and lintel.

The operating mechanism which extends some 12 or 15 ft. above water level will be covered with a house of appropriate design, in harmony with the surroundings in Queen Victoria Park, within the limits of which the headworks are located. The sluice was made by Ransomes & Rapier, London, England, to conform to specifications of Messrs. Nunn, engineers of the Ontario Power Co.

The First Street Tunnel, Washington.—I.

The First Street double-track tunnel under Capitol Hill is being built to connect the passenger tracks of the Pennsylvania R. R. with the new union terminal station at Washington, and was described in The Engineering Record of September 3, 10 and 17, 1904. It has a total length of 4,000 ft., of which about 1,600 ft., mostly at the south end, have been built in open trench with a maximum depth of 55 ft., as already described in the previous article.

The tunnel through the open cut section is on a 4-deg. 20-min. curve, which is continued for about 150 ft. in the driven tunnel, the point of tangency being at B St. south. From this point the tunnel continues on a tangent to the north end. The tunnel has a light grade falling to the south, the maximum depth below the surface to the tunnel invert is about 70 ft. It was decided to build about 2,400 ft. of the deepest portion as a driven tunnel, and work on this part of the contract is now well under way.

The material overlying the tunnel in general consists of gravel. At about 20 ft. above the tunnel grade a stratum of white sand is usually encountered. This sand stratum in places extends to a considerable depth below the tunnel sub-grade. It is underlaid by a stratum of hard, blue clay, which on portions of the work extends above the tunnel sub-grade to a height of several feet, the plane of separation between the two strata being very irregular.

The clay forms an impervious bed and the sand which immediately overlies the clay stratum carries a large amount of water, having when saturated the properties of quicksand, making excavation of drifts in it a difficult matter. When thoroughly drained it is handled with comparative ease.

Two 6x8-ft. timbered shafts have been sunk in the axis of the tunnel at distances of about 1,800 ft. and 2,700 ft. from the south portal. They were sheeted in the usual way and extend about 6 ft. below subgrade so as to form sumps. These proved very efficient in draining the water which flows into them from the top of the clay stratum, and is pumped out by pulsometers made by the Pulsometer Mfg. Co., of New York, which deliver to the sewer in the street above. Besides these shafts, three 6-in. pipes have been driven from the surface to the level of the crown in the axis of the tunnel and afford points at which plumb bobs can be suspended to produce the alignment under ground.

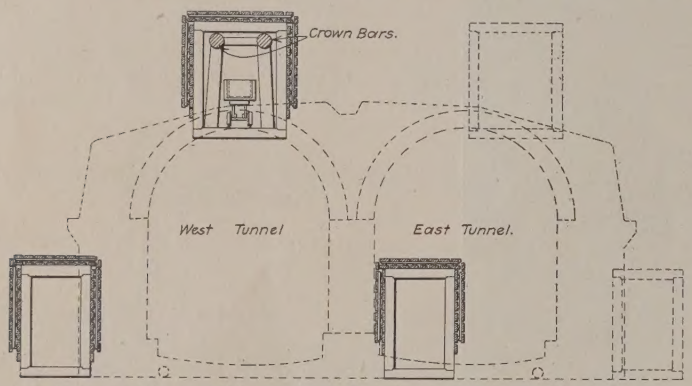
The two tracks in the finished tunnel will be separated by a center vertical wall 4 ft. thick and covered by brick arch roofs resting on it and on the concrete side walls and filled over their haunches with concrete and sand, as shown in the general cross-section published Sept. 3, except that the concrete invert is made continuous under the track between the side and center walls, as indicated by the drawings in this description. The other dimensions of the finished double-track tunnel are: Width, 48 ft.; height, 24 ft.; width for each track, 16 ft.; height for each track, about 20 ft. in the center. The total quantities of the principal materials required for the tunnel will be about 15,000 cu. yd. brick arch masonry; 6,000 cu. yd. ashlar masonry in the center wall and 50,000 cu. yd. concrete. About one-fourth of these amounts has already been put in place, and the work is now progressing at a rate which would indicate its probable completion in from 6 to 10 months, according to whether or not the tunnel is commenced at the north end or is continued wholly from the south end.

On account of the difficulty in excavating the sand and protecting the roof and sides of the tunnel and its wide span, especial methods have been developed for the execution of the work, in which an unusually large amount of power is utilized, so that machinery replaces hand labor wherever possible. The general principle is to build the two sides of the tunnel separately and successively by the crown bar method, excavating a large portion of the spoil by a steam shovel, handling the concrete and sand for the backfill by an electric conveyor and using traveler towers and derricks for the stone, brick and concrete masonry construction.

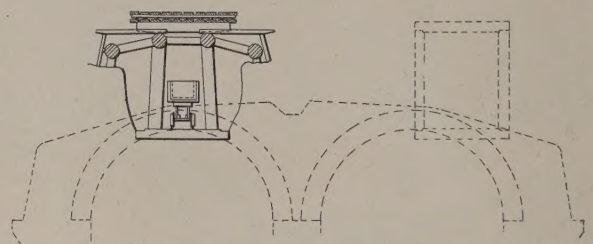
The construction may be divided into thirteen operations or groups of operations, as indicated by the accompanying diagrams. First, a crown drift and two lower drifts are driven for the west side of the tunnel. These are excavated by the ordinary method of timbering and poling boards and are made with somewhat larger dimensions than are usual, the upper drift being 6½ ft. wide and 8 ft. 8 in. high in the clear and the lower drifts 4¼ ft. wide and 8 ft. high. They are timbered with 10x10-in. bents about 5 ft. apart. In the upper drift the muck is removed by ½-yd. end-dump cars on a 20-in. gauge track, which at the rear end is carried beyond the bench and suspended for about 50 ft. from the roof of the tunnel, so that it can be delivered to the large spoil cars over the heads of the men working at the bench. In the bottom drifts the muck is removed in cars similar to those used above, running on 20-in. industrial tracks furnished by Mr. Arthur Koppel, New York. Each drift is worked in three 8-hour shifts daily, advancing about 10 ft. in 24 hours.

At present the lower drifts in the west tunnel are in very hard clay, where the progress is somewhat more difficult than in the upper drift, which is through gravel. One miner and helper work together in the heading digging the clay with pickaxes and are relieved every few minutes by the other miner and helper, thus keeping the work in continuous progress. As fast as the upper drift advances, a pair of crown bars are set in it as shown by the diagram of the first operation. The crown bars are 12 in. in diameter at the small end and are 24 ft. long. Great care is taken to set them accurately in the required positions, which are measured with vertical and horizontal offsets and frequently checked to the level and transit lines run through the drifts. They are thus placed very exactly in the required positions. The poling boards are 3 in. thick, 6 in. to 8 in. wide and 6 ft. long.

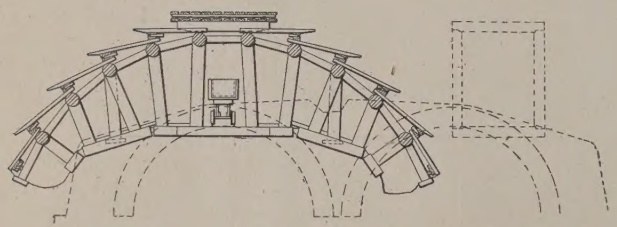
In the second operation poling boards are driven in the roof and the sides are enlarged to receive the second pair of crown bars. In the third operation the side excavation is continued to reach the bottom drifts, thus removing approximately semi-circular segments of earth with the bottom of the excavation about on the line of the extrados of the finished tunnel. These operations are in progress while all of the headings are being continuously advanced. At the



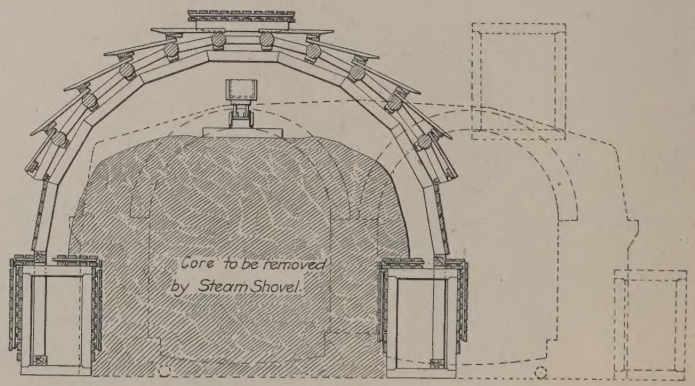
First Operation. *Drifts Excavated for First Tunnel, and First Pair of Crown Bars set.*



Second Operation. *Widening Upper Drift: Two Pairs of Crown Bars set.*



Third Operation. *View showing all Crown Bars in position and Ground in readiness to Sink Trenches to place Wall Plates.*



Fourth Operation *Showing Crown Bars wedged on Segmental Timber Arches, all Props removed and ready for Excavation.*

Principal Operations of Excavation, Timbering and Construction of Twin Tunnels

same time shallow trenches are dug on the outer edges of the bottoms of the lower drifts and in them a continuous concrete footing about 2 ft. wide and 15 in. deep is laid as close as possible to the heading. This is entirely outside the lines of the tunnel masonry and is allowed to set as long as possible before placing on it the sills for the arch timbering. In some cases where quicksand has been encountered, these footings were set with difficulty, and in order to anchor them securely sections of 4-in pipe 4 ft. long were driven vertically in the trench about 1 ft. apart. The quicksand in them was scooped out and replaced by concrete and their upper ends were buried in the footing, thus providing considerable resistance to lateral displacement.

The fourth operation consists of setting timber arches 2½ ft. apart on centers, which are made with nine duplicate segments of 12x12-in. long leaf yellow pine timber about 6 ft. 2¼-in. long on the outside. The feet of the lower segments rest on continuous 12x12-in. sills carried on vertical posts 8 ft. high. As soon as the arches are completed the crown bars are tightly wedged up against them and the radial struts are removed, leaving all the space below the arch unobstructed. The span of the arch is 34 ft. in the clear and great care was taken to make the vertical posts short so as to keep it as low as possible and reduce the area of the vertical sides exposed to lateral pressure. Otherwise segmental arches and taller vertical posts might have been used.

The nature of the ground is such that very heavy pressures are developed on the arches and in some cases rendered it necessary to reinforce the original segments. In these cases intermediate arch ribs were inserted between the original ones, making an almost solid timber roof vault 12 in. thick. The widening of the drifts and arch timbering of the second, third and fourth operations are executed by two 12-hour shifts who are able to keep up this work as rapidly as the miners can advance the drifts.

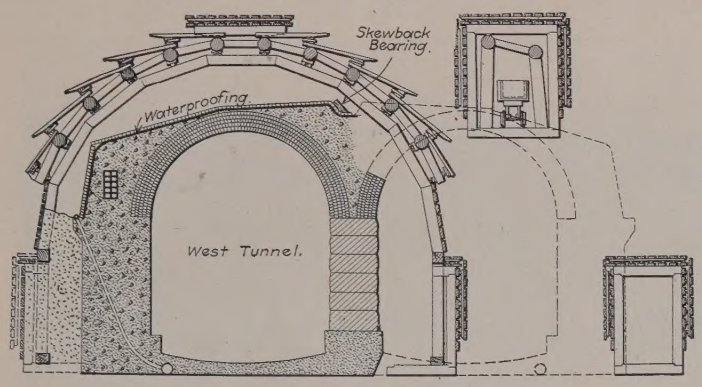
In the fifth operation a Little Giant steam shovel, manufactured by The Vulcan Iron Works Co., and operated by compressed air, excavates the core under the arch timber, which, for the west tunnel, contains about 28 cu. yd per linear foot. The shovel works down to 1 ft. above subgrade, the remainder of the excavation being made by hand to avoid danger of disturbing the outside material. The steam shovel handles about 500 cu. yd. spoil in one 10-hour shift working only at night. It has a 1¼-yd bucket and delivers to 3-yd., side-dumping, wooden dump-cars. These are hauled in trains of two or three on a 3-ft. gauge track by two General Electric and two Baldwin-Westinghouse mine locomotives. They deliver the cars to the foot of the trestle described in the issue of September 3 and are drawn up the incline by a steel cable and Lidgerwood hoisting engine operated by a 25-h.p. General Electric motor. The cars dump into elevated storage bins of 170 cu. yd. capacity fitted with horizontal sliding bottom gates, through which the muck is delivered to wagons and taken to places where the railroad company is making a fill inaccessible by train.

The grade of the lower heading is not sufficient for satisfactory drainage, and sumps are provided near the forward end, and Snow pumps operated by compressed air are installed in each heading with a long 3-in. discharge pipe, which delivers the water to a second sump located a little in the rear of the steam shovel. This sump also received drainage from the completed tunnel in the rear and is emptied by a Lawrence centrifugal pump with a 3-in. discharge pipe carried beyond the portal of the tunnel. This pump is operated by a 10-h.p. General Electric motor, which is mounted with it on a movable wooden platform that can be easily carried forward as the work progresses, sumps being dug about 50 ft. apart near the center line.

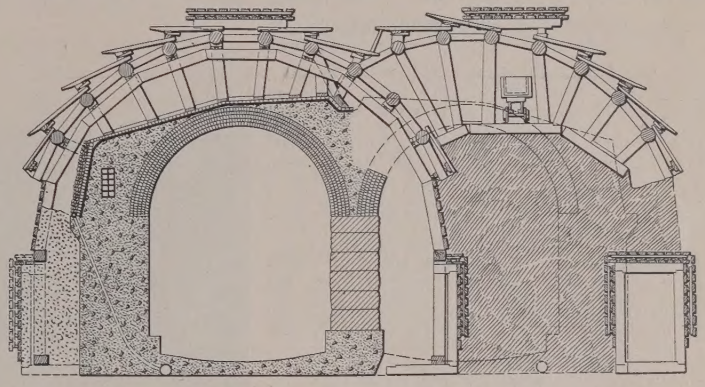
In the sixth operation the masonry for the west side of the tunnel is built complete and waterproofed. In the seventh operation radial posts are set on the finished masonry to support the arch roof timbers and the west side of the tunnel is backfilled. In the eighth operation an upper heading and a lower heading are driven for the east tunnel, care being taken not to extend them in advance of the finished masonry for the west side of the tunnel. In the ninth operation the upper heading is widened on both sides to reach the east lower drift and the timbering for the west tunnel, the crown bars and poling boards being placed as decribed for the west side. This operation is simultaneous with the sixth operation. In the tenth operation the arch timbers are set for the east tunnel and take bearing in the axis of the tunnel on the inclined face of a horizontal sill or continuous skewback placed in a seat prepared for it in the upper part of the concrete backing of the west tunnel roof. The east tunnel core contains about 11 cu. yd. per lineal foot, and in the eleventh operation it is excavated by the steam shovel as described for the west tunnel in the fifth operation. Afterwards the masonry is completed in the twelfth operation and the work is finished by backfilling in the thirteenth operation, all of the timbering being left permanently in the ground except the arch timbers for the west side, which are removed.

The tunnel was designed by and its construction is under the supervision of the engineering department of the Pennsylvania R. R. Co., Mr. W. H. Brown, chief engineer, and Mr. Robert Farnham, Jr., assistant engineer. The contractor is the New York Continental Jewell Filtration Co., Mr. C. L. Parmlee consulting engineer, and Mr. E. G. Williams resident engineer.

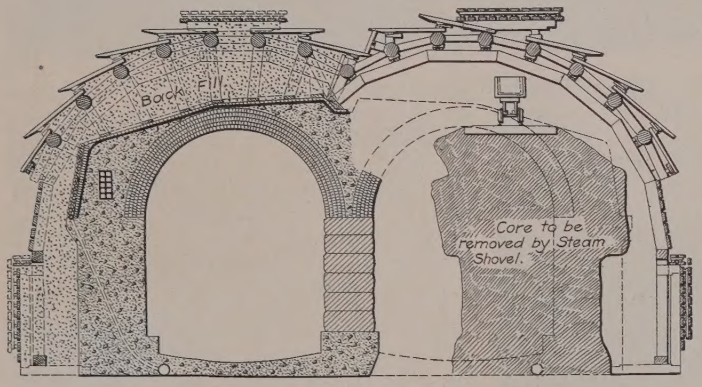
(To be continued.)



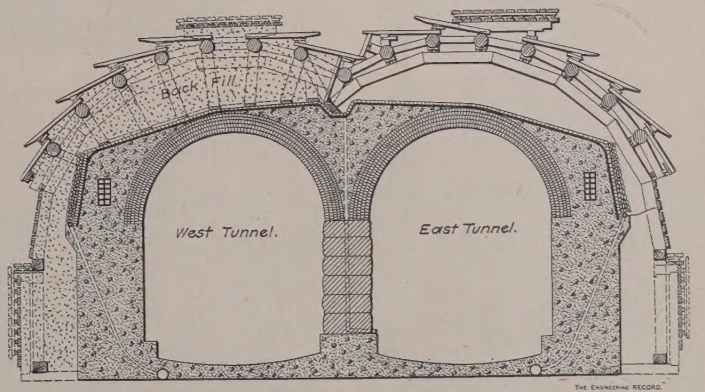
Sixth and Eighth Operations. *Masonry completed in First Tunnel Heading and Bottom Drift completed in Second Tunnel.*



Ninth Operation. *Showing Crown Bars in position in Second Tunnel and Radial Struts replaced in First Tunnel. Back-Filling for West Tunnel is in place but is omitted in Drawing.*



Tenth Operation. *Segmental Arch removed in First Tunnel and set in Second Tunnel, ready for Excavation by Steam Shovel.*



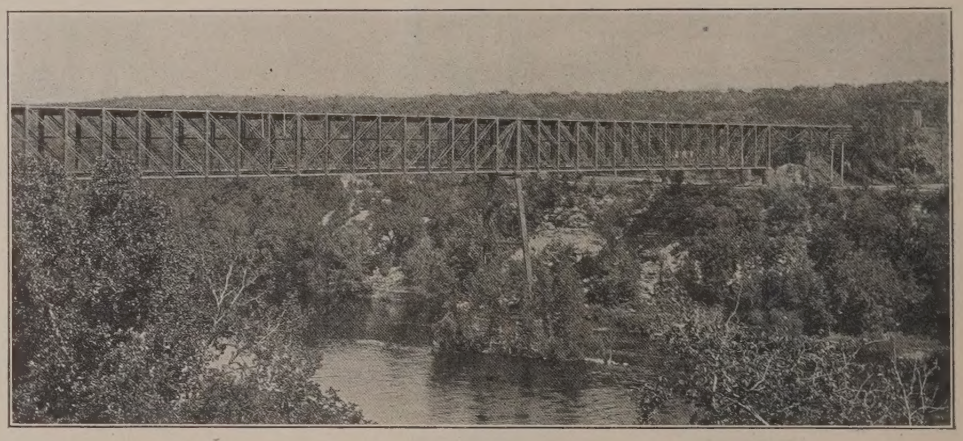
Masonry completed, ready for Backfilling. Twelfth Operation Completed.

Principal Operations of Excavation, Timbering and Construction of Twin Tunnels.

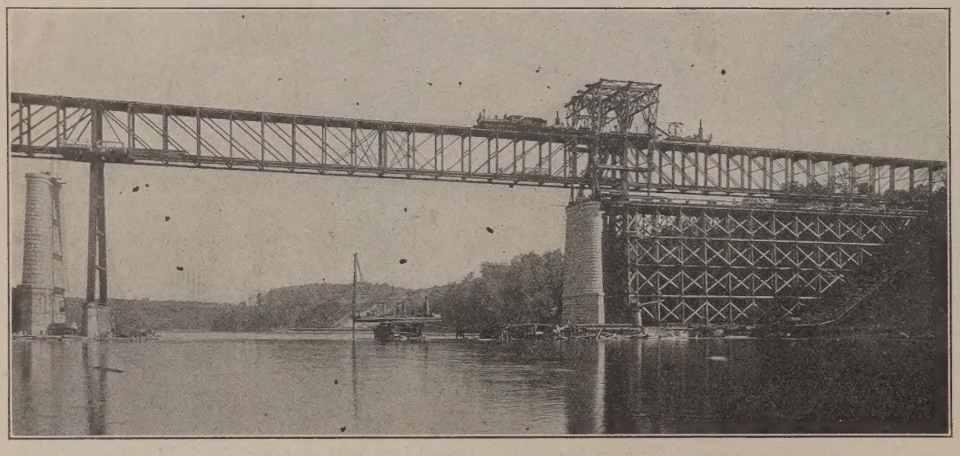
The Erection of the Short Line R. R. Bridge at Minneapolis.

One of the most important of the recent bridge renewals of the Chicago, Milwaukee & St. Paul Ry. was the building on the same alignment, without interrupting traffic, of a heavy double-tract structure to replace a light single-track bridge across the Mississippi River at Minneapolis. The original bridge was designed by the late C. Shailer Smith and was built in 1880 by the Edgemoor Bridge Co. It was designed to carry much lighter locomotives and train loads than are now used on this line and had three main deck spans at a clear height of 76 ft. above high water. The two 272-ft. shore spans had Whipple trusses 30 ft. deep and 18 ft. apart which carried the railroad track at the top chord level and carried a highway floor on the bottom chords. The 324-ft channel span included the cantilever ends of the shore spans and was seated on steel transverse bents with masonry piers at high-water level. The west approach consisted of a 40-ft. and 60-ft Fink truss deck span with their adjacent ends supported on a steel rocker bent. In the east approach there were three 60-ft Fink truss spans with rocker bents.

The old bridge was removed in order to provide a double-track structure with a capacity for the increased weight, volume and speed of traffic. The new bridge is 1,060 ft. long, 70 ft. in the clear above high water and weighs about 6,577,000 lbs. The lengths of the spans are varied to provide for the construction of new piers clear of the old ones. The piers are entirely of masonry, those for the channel span have a total height of about 100 ft., are built of Kettle River stone up to the belt course and are chisel pointed on the up-stream end; above the belt course they are built of Stone City stone, rock faced.



Old Bridge before Commencement of Renewal.



Old Bridge, New Piers, Shore Span Falsework and Pile Driver.

The superstructure consists of three main spans, two approaches of through plate girders from 30 to 65 ft. long and one steel tower.

The main spans have pin-connected deck trusses of a uniform depth of 40 ft. with vertical posts and subdivided panels. The channel span is 319 ft. 8 in. long on centers and the two shore spans are 288 ft. 8 in. and 231 ft. 10 in. in length. The details conform to standard practice and the design is special in that there is a solid Z-bar floor laid on nine lines of plate girder stringers, as shown in the illustration published in The Engineering Record March 18. The double tracks are each proportioned for two 177½-ton locomotives followed by a train load of 5,000 lbs. per lin. ft.

The substructure was built and the superstructure was fabricated in accordance with ordinary methods and practice, but special difficulties were encountered in the erection on account of necessity of assembling the new superstructure, transferring the track in service to it from the old bridge and removing the old bridge without interrupting traffic. Piles were driven in the river by a double cantilever, counterbalanced, pivoted land piledriver. They were arranged in transverse bents and capped a few feet above low water level. Under the channel span double rows of the piles were spaced to form four piers which supported three falsework spans, leaving 50 or 60 ft. clear waterways for the passage of log rafts. Each span was made with a pair of old Howe trusses removed from bridges on other parts of the line and reinforced for this service. On these trusses and on the caps of pile bents beyond them were built bents of ordinary framed falsework on which the new superstructure was erected and the old removed. Bents of falsework were seated on sills on the old tower piers and on the shore at each end of the bridge. They were all made with vertical posts, four stories high, with ledger pieces at each story and longitudinal X-bracing in every panel of the outside posts. Materials were received at track level at the west end of the bridge and an inclined service track was built parallel to the bridge axis from that point to the water's edge and to the west main pier.

A strident tower traveler and a work train consisting of two 20-ton derrick cars with a flat car between them were used to handle the material for the new spans. The traveler was rigged with tackles that were hung over the center line of each truss, and were operated by stationary engines on the bank. The material for the new bridge was strung out along a temporary side-track at the west end of the bridge, and when the crew was ready for members, such as two posts, the work train on the side-track would load them on the flat car in such a manner as to cause no delay on the bridge and then run them out to the required position. The derricks would pick up the piece, swing it to the traveler tackles and then run off the bridge to the side track. The new pieces were suspended from the traveler clear of trains, and assembled without interference from traffic.

The new bridge was designed with the same center line as the old bridge, and the panel points of the new were located midway between those of the old. These provisions, together with the details of design and the increased height from center to center of trusses and their greater distance apart, allowed the new trusses to be erected outside the old ones and the floor beams and sway bracing to be put in place without interfering with the old structure. When the three main spans were thus far erected, the track was changed from the old spans to the new by working between trains, changing six to eight panels at a time, and carrying the old track on the new stringers. The Z bars were placed between the old ties and riveted to the new stringers all the way across the bridge. The old track was then jacked up, and the deck plates slipped under it. The old track being in the center of the two new tracks, it alone was used for traffic until the two new tracks were finished and their connections made at the ends of the bridge.

The design and complete shop drawings were made in the office of the bridge and building department of the Chicago, Milwaukee & St. Paul Ry. by Mr. Onward Bates, formerly engineer and superintendent of bridges and buildings of the company. The erection was done by the railroad company, under the direction of Mr. C. F. Loweth, present engineer and superintendent, with Mr. Onward Bates as consulting engineer.

The steelwork was built by the Lassig branch of the American Bridge Co. Messrs. H. Dearborn & Son, F. Ericksen & Co. and the Minnesota Sandstone Co. furnished the cut stone for the substructure. The bridge was erected by Mr. Eugene Greenwald, who has been chief erector for the railway company for nearly twenty-five years, and erected the old bridge that had been replaced. The Engineering Record is indebted to Messrs. C. F. Loweth and J. J. Harding, and F. M. Carroll, of the bridge and building department of the Chicago, Milwaukee & St. Paul Ry. for the data for the present article.

The Casting Loss in the pipe foundry of the Lynchburg Foundry Co. at Lynchburg, Va., has been unusually small. For the twelve months ending with November, 1904, the record was: Nov., 1903, 1.28 per cent.; Dec., 0.94; Jan., 1904, 0.73; Feb., 0.52; March, 0.11; April, 0.16; May, 0.48; June, 0.16; July, 0.17; Aug., 0.04; Sept., 0.18; Oct., 0.32; Nov., 0.08.

New Power Plant for the Henry Heide Candy Factory.

Owing to a large increase in the manufacturing facilities and a complete power reorganization at the factory of Henry Heide, New York City, a new power-generating plant is being installed which has interesting features of arrangement and design. The changes under way involve the construction of a new factory building adjoining the present one on Vandam St. and a more general use of electrical driving of the machinery. The power plant is intended to provide for the greater demand and will be a model installation of modern generating equipment.

The plant will be located under the driveway, between the old and new buildings, and is designed to furnish light and power to both. The existing plant in the old building is to be discarded altogether, but one of the 100-kw. units forming a part of it will be moved to the new dynamo room and there utilized. The old generating plant consisted of three units, one of 50 kw., one of 75 kw. and one of 100 kw. capacity, consisting of generators of the Walker Co. manufacture, each directly driven by a Ball & Wood simple high-speed engine. The largest of these units will be utilized in the new plant. The new generating plant will consist of two new units of 300 kw. capacity each, and the old unit mentioned, which is of 100 kw. capacity, making a total of 700 kw. capacity. The two new generators will be supplied by the Western Electric Co., and each will be directly connected to a Corliss engine of the tandem, compound type, manufactured by the Allis-Chalmers Co. at the West Allis shops.

The generators are of the direct-current type, compound-wound, and operate at 120 volts. The reason for using 120-volt system, instead of 240 volts, which would be the natural voltage for a plant of this character, was owing to the fact that a large number of 125-volt motors were already in operation in the old factory, and also owing to the fact that it was possible to use one of the present generators. It would have been impossible, therefore, to raise the voltage of the system without discarding apparatus on hand representing a considerable value, and which value would more than offset any saving in copper represented by the installation of a 240-volt system.

The specifications of the engines were as follows: Type, horizontal, tandem-compound, noncondensing; length of stroke, 42 in.; diameter of high-pressure cylinder, 18 in.; diameter of low-pressure cylinder, 28 in.; speed not to exceed 100 r.p.m.; piston speed, 700 ft. per minute; diameter of fly wheel, 14 ft.; approximate weight of fly wheel, 25,000 lb. Capacity, 465 hp. at 120 lb. steam pressure.

The engine was equipped with a Rite's governor especially adapted for the Corliss engine in place of the usual fly-ball governor. This type of governor has been specified by the designing engineer for use on Corliss engines in all his specifications recently, as for engines designed for lighting plants, as it is found preferable to the fly-ball governor. In the first place, it affords much better and quicker governing, and second, it admits of a design so as to prevent fly-wheel accidents really due to the failure of the governor to act, owing to breaking of the governor belt, etc. The receiver for the engine was placed underground and was not equipped with reheating coils, for the reason that it was not believed that for installations of this character the saving effected by the installation of these coils was sufficiently great to overcome their disadvantages. The cylinder heads were not steam-jacketed for the same reason. The valves will be operated by separate eccentrics for both cylinders, thus giving a cut-off range of from zero to three-quarters stroke.

The cast-iron base plate placed under each of the lugs supporting the field magnet frame of the generator is designed with a slot running longitudinally in the direction of the shaft; a saddle plate is secured to the under part of the lugs of the field magnet frame, which has a rib corresponding to the groove in the base plate. By means of a removable jack screw which can be set in socket holes placed at intervals along the base plate, it is possible to readily and conveniently shift the whole field magnet frame in the direction of the shaft, and thereby gain access to the armature and commutator for repairs.

The switchboard is of an interesting design. It consists of three sections, consisting of dynamo panels, one for lighting and one for power. A total indicating ampere meter, a registering ampere meter and recording wattmeter have been provided for each of the two feeder panels, so that exact records may be kept of the current consumption for lighting and for power separately. All the fuses for the feeder circuits and for the dynamos have been placed back of the board. In the case of the dynamos, the fuses are placed on a horizontal panel at the lower edge of the board. The feeder fuses are placed on vertical panels back of the corresponding feeder panels. The feeder conductors end at a slight distance below the top of the switchboard, the feeders being extended by means of extension boards in each case to the fuse connector opposite the corresponding feeder switch.

The entire generating equipment, inclusive of engines and also the electrical details, is designed and being installed by Mr. C. O. Mailloux, consulting electrical engineer, 76 William St., New York.

New Short Line R. R. Bridge in Service.

Falsework on Trusses, New Shore Span Completed, and Traveler Ready to Remove Second Old Span.

Aerator for Water Works Reservoir.

An aerator and fountain, arranged in an interesting manner in the water-works system of Newark, N. J., has just been put in operation. The water supply for the city is brought by pipe lines for some distance from large storage reservoirs, and delivered to three small reservoirs from which the distribution system is directly supplied. One of these distributing reservoirs is in a park which has recently been opened by the city, and to add to its appearance this fountain was built at the center of the reservoir. It consists of 33 vertical wrought-iron pipes, with flat jets at their discharge ends, which produce a fan effect on the issuing water. The pipes are spaced in three concentric circles at the middle of the reservoir, nine in a cluster at the center, eight on a radius of 12.5 ft. and the remaining sixteen on a radius of 25 ft. The discharge of the pipes in the central cluster is about 3 ft. 6 in. above high water level in the reservoir, while the discharge of those in the outer circle is just about at high water level, with those in the middle circle at an intermediate height. The fountain is supplied by a 10-in. main laid along the bottom of the basin. Water is delivered at the base of the pipes under a pressure of from 40 to 55 lbs., and about 4,000,000 gallons of water pass through the pipes in a day. The central streams reach nearly 40 ft. above the high-water level in the reservoir when water is supplied under the maximum pressure and the discharge from the jets forms a cone shape fountain nearly 100 ft. in diameter at the base.

A FLOATING DRYDOCK has just been completed in the yards of the Maryland Steel Works for the United States Government for use in the Philippines. The dock can accommodate a 16,000-ton battleship, and after it has been tested will be towed to the Philippines.

Substructure and Falsework Construction for the Gilbertsville Bridge.

The Illinois Central Railroad Co.'s new bridge across the Tennessee River at Gilbertsville, Ky., is located 2,600 ft. up stream from the old bridge in a diversion of 9,400 ft. in total length. It has three steel truss fixed spans of 300 ft. each, two of 150 ft., one 450-ft. draw span and a 984-ft. ballast floor approach made with six-pile trestle bents of creosoted timber. The substructure for the main spans consists of six river piers and two shore piers, all made of reinforced concrete, as described in The Engineering Record of March 4. The shore pier excavations were made by hand in open pits with single sheeting.

For the river piers the bottom was dredged about 17 ft. below low water to a stratum of very hard cemented gravel into which shod piles were driven 16 to 20 ft. and cut off 2 ft. above the bottom with a submerged 42-in. circular saw. Cofferdam piles were then driven, 10 x 12-in. waling timbers bolted to them outside, and 10 x 12-in. triple-lap sheet piles driven against the latter, penetrating the gravel from 4 to 6 ft. and forming a cofferdam with the top 15 ft. above low water. The approximate dimensions of the cofferdams were 34 x 78 ft. for the five rectangular ones and 26 ft. on a side for the octagonal one for the circular pivot pier.

The cofferdams were sealed by 3 ft. of Owl Portland cement concrete, lowered below the surface and placed where required under water by a one-yard bottom-dump bucket. The rectangular cofferdams were braced with transverse struts and knee braces in horizontal planes, engaging the waling pieces. The first set was put in just above the surface of the water and the successive sets were put in 6 or 7 ft. apart as the water was pumped down. The octagonal cofferdam was braced by horizontal annular trusses providing a balanced, arch-like resistance to the external pressure and affording clearance for the concreting and moulds, a form of bracing thought to be novel for this purpose. The cofferdams were unwatered by one 6-in. submerged centrifugal pump and one 6-in. and one 8-in. centrifugal Goulds pump. After the cofferdams were once drained the sheeting was calked and leakage was easily handled by a single 6-in. pump, the other two pumps being rigged on one barge and moved from pier to pier.

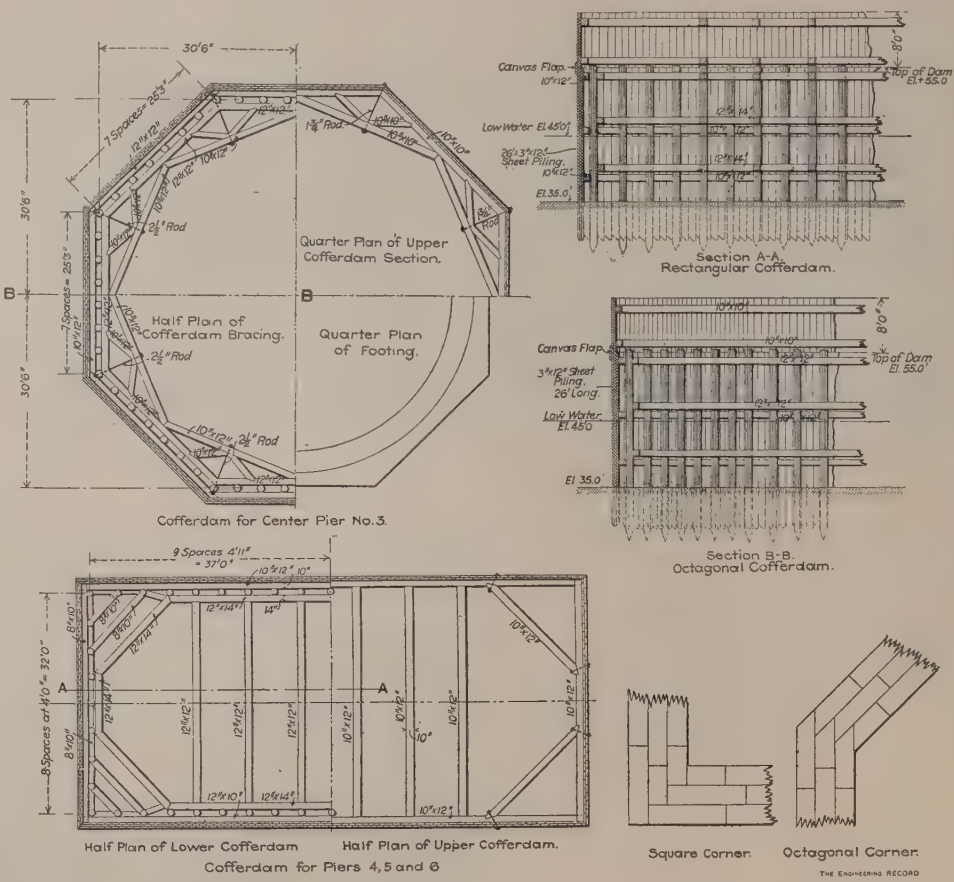
The concrete forms were made of 2-in. plank, horizontal for the sides of the piers and vertical for their curved ends. The pressure on the sides was provided for by permanent horizontal transverse 5/8-in. through tie-rods cut to accurate lengths and threaded to engage the inner ends of sleeve-nuts 2½ in. long held 1½ in. from the faces of the moulds by short bolts through the moulds, and a waling piece outside the studding. The outside bolts were easily removed and the holes they left filled with mortar when the moulds were taken down.

The total amount of concrete was about 17,300 cu. yd.; the best concreting record was 6,100 yd. made in November and the greatest week's work was 1,800 yd. The piers were commenced in June and finishd Jan. 2, one week ahead of contract time. During their construction the river was very low, with no floods, and an average force of 400 men was employed during September, October and November, when the weather was exceptionally fine. During October, November and December about 100 men worked night shifts. Two fixed concrete mixing plants were installed on shore and two movable concrete mixing plants were installed on barges. The concrete barges were fitted with an elevated platform in the center with a charging hopper through which the materials were delivered to a Smith mixer discharging to a bucket handled to the forms by a stiff-leg boom-derrick on a tower at one end of the barge which commanded the finished pier. At the other end of the barge a second stiff-leg derrick served the concrete mixer, handling sand, broken stone and cement from the supply barges moored alongside. The substructure plant comprised, in addition to the concrete machinery, one floating steam-hammer piledriver, two floating drop-hammer pile-drivers, one floating saw arbor, a dredge, twenty-two barges, one steam towboat and one gasoline launch. Much satisfaction was felt by the railroad management with the character of the finished work and the manner in which it was executed.

The falsework for the truss spans was peculiar in that it was practically only one story high, the upper part being continuous with the lower part and having no framed bents resting on the pile tops. Spliced piles were driven to make single members reaching to the caps which received longitudinal stringers for the traveler tracks and camber blocking. The upper part of each bent was divided into two X-braced panels by horizontal struts at water level and half way from there to the caps. Each longitudinal panel between bents was similarly braced in vertical planes.

The vertical piles were driven and braced and the caps and stringers were set by a special overhead double piledriver traveler designed and constructed by the contractors. It had a horizontal timber platform, mounted on wheels, and carried at the front corners two vertical masts, X-braced together and having stiff legs running in vertical longitudinal planes to the rear of the platform. To the foot of each mast was pivoted a boom having suspended from its point a pair of hammer leads. This machine gave good satisfaction and drove as many as two bents of long piles in one 9-hour day. It was designed by the Kelly-Atkinson Construction Co., Chicago, who was the contractor for the erection work. The Bates & Rogers Construction Co., Chicago, was the contractor for the substructure work.

Mr. A. S. Baldwin, engineer of construction, was in charge of all the work. The substructure was detailed in the engineering department of the Illinois Central R. R., Mr. H. O. Wallace, chief engineer, while Mr. H. W. Parkhurst was engineer of bridges and Mr. F. H. Bainbridge was assistant engineer of bridges. The steel trusses were designed by Mr. R. E. Gaut, engineer of bridges. Mr. H. H. Hadsall was resident engineer of the work.


Quarter Plan of Upper Cofferdam Section.
Half Plan of Cofferdam Bracing.
Quarter Plan of Footing.
Cofferdam for Center Pier No. 3.
Canvas Flap.
Top of Dam El. 55.0
Low Water El. 45.0
El. 35.0
Section A-A. Rectangular Cofferdam.
Section B-B. Octagonal Cofferdam.
Half Plan of Lower Cofferdam.
Half Plan of Upper Cofferdam.
Cofferdam for Piers 4, 5 and 6
Square Corner.
Octagonal Corner.

Cofferdams for Fixed and Pivot Span Piers, Gilbertsville Bridge.

A Large Sewage Disposal Plant.

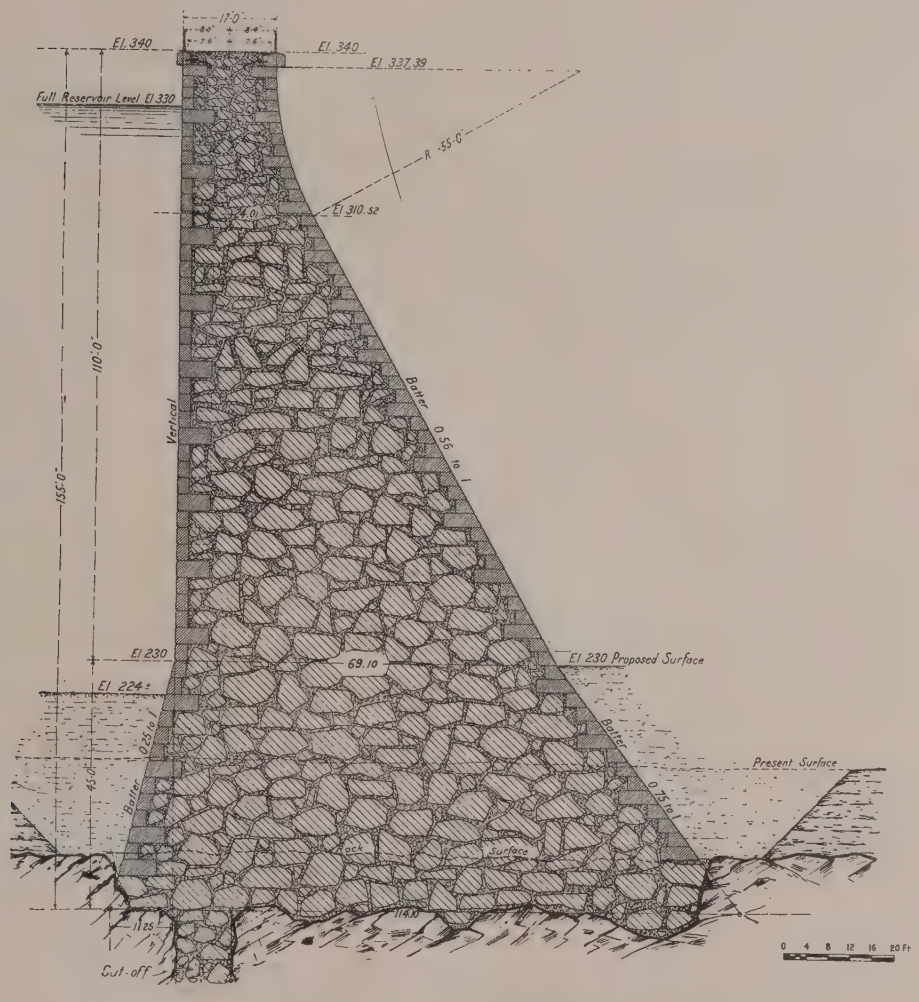
A sewage disposal plant, consisting of twelve precipitation tanks and twenty filters, built of reinforced concrete, has just been completed at Chester, England. The site is only a few feet above the water in an adjacent tidal estuary and the sub-soil is old seashore sand. The nature of the sub-soil and the location of the site precluded any deep footings, the "Surveyor" states in a description of the plant, so the top soil was stripped and the whole superstructure built on the sand. The precipitation tanks and filters are all circular. The tanks are built in two groups on a 180x200-ft. reinforced concrete slab, 21 in. thick, which extends 6 ft. outside of the tank walls on all sides. The filters are 50 ft. in diameter and are arranged in four parallel rows of five each. They are built entirely of reinforced concrete and each filter is built on 76 brick columns, which are spaced in circular rows with a reinforced concrete footing under each set of the radiating columns. The concrete channels around the precipitation tanks and between the filters are also built on brick columns with reinforced concrete footings, more than 1,700 brick columns being used in building the works. The footings built in this manner have supported the heavy superstructures and their contents on the uncertain foundations without apparent settlement.

The Cross River Reservoir for the Water Supply of New York City.

Readers of The Engineering Record have already been made familiar with New York City's urgent need for a large additional water supply and the immediate necessity for providing more storage on the Croton River watershed, the present chief source of supply, to meet the emergency of extremely dry or even ordinarily dry years during the construction of the great new work, which now seems assured by the recent action of the New York state legislature. The storage per square mile on the easterly part of the Croton watershed is much lower than on the westerly. In order to conserve part of the water wasted each year the 30 billion gallon New Croton reservoir has been constructed, and recent careful studies have shown that, under existing circumstances, two more reservoirs of approximately 30 billion gallons combined capacity can be constructed advantageously.

The Cross River reservoir, of 10 billion gallons capacity, is intended to store the surplus water of an easterly tributary of the Croton River having a watershed of about 30 sq. miles. The Croton Falls reservoir, of approximately 20 billion gallons capacity, will be located on the main river with its dam below the confluence of the east and west branches where it can receive all the surplus water from the upper half of the watershed. Surveys and studies for these two new reservoirs have been in progress for a number of months; the former reservoir is now ready for contract and the latter probably will be during the summer.

The Cross River dam is to be built on a site one mile east of the Katonah station on the Harlem division of the New York Central & Hudson River R. R. about 40 miles from New York City, and the reservoir will extend about 3¼ miles southeasterly from the dam. No railroad will be disturbed by its construction, and only one small village and about 3 miles of highway will be submerged. The dam is the chief feature of interest and expense and is noteworthy principally because of the materials adopted and the scheme outlined by the engineers for its rapid construction. The maximum height of the dam will probably exceed 150 ft. and its length will be nearly 900 ft. It is to be built of cyclopean masonry faced with large concrete blocks. Concrete blocks were adopted for this purpose not merely for the sake of saving about a quarter of a million dollars, but largely because of greater certainty in the rate of construction thereby secured through the avoidance of possible delays in receiving cut facing stone, all of which would have to be brought from a distant quarry. Gneiss suitable for concrete and cyclopean masonry is locally available, and sand and gravel are found near the site of the dam. As now designed, the dam and its appurtenances contain no cut stone masonry of any description.



Maximum Section of the Cross River Dam

To control the river during construction a small portion of the foundation masonry of the dam is to be built as soon as possible after letting the contract, so as to support two 60-in. steel pipes extending through the dam; from each end of these pipes a timber flume is to be built extending to a temporary earth dam. One of these temporary dams will be above and the other below the limits of the work for the main dam.

The main features of the scheme for rapid construction, as outlined in the specifications are a spur track, about one mile long, from the railroad, large timber trestles for supply railroads close to the dam on both upstream and downstream sides and steel derrick towers built within the dam, similar to those used in the extension of the new Croton dam, which were described in The Engineering Record, Sept. 10, 1904. Practically, the whole location for the spur track is on land owned by the city.

It is expected that during the current season the principal part of the excavations for the dam will be made and the masonry built in the bottom of the valley up to or slightly above the present ground level. During the winter three steel derrick towers, 25x50 ft. in plan, and 50 ft. high, are to be erected on the masonry and equipped with four stiff-leg derricks each, so that without shifting a derrick the masonry can be completed for a height of 50 ft. across the full width and length of the main dam. During the winter two large timber trestles are also to be built across the valley and equipped with tracks and mast and boom derricks. These trestles will be wide enough for three 3-ft. gauge tracks and a narrow storage space for materials, and it is expected that they will not need to be disturbed until the dam is completed. From one end of the trestle railway tracks are to extend to the quarries, and from the opposite ends inclines can be laid up the hillside to the concrete mixing plants and storage yards.

When the masonry shall have been built to the top of the three steel towers just mentioned, five more towers, 25x50 ft. in plan and 25 or 30 ft. high, and set so as to cover the full length and width of the dam, are to be built. Above their tops the dam is too thin for the use of the internal towers and wooden towers carrying one or two derricks will be built on the trestle, against the face of the dam.

Two traveling cableways are also to be provided early in the progress of the work to span the valley above the top of the dam, to aid in erecting the towers and setting up derricks, and to supplement the towers in building the masonry, especially in the upper part of the dam. The schedule of progress calls for the laying of masonry during the summer of 1906 at rates of 18,000 to 25,000 cu. yd. per month. The essence of the scheme is the elimination of interruptions to the actual operation of building masonry.

The principal quantities involved in the contract for the Cross River reservoir are approximately as follows: Earth excavation, 188,000 cu. yd.; rock excavation, 60,000 cu. yd; timber and lumber, 1,500,000 ft. b.m.; steel for derrick towers, 160 tons; Portland cement, 135,000 bbl.; concrete facing blocks, 17,500 cu. yd.; monolithic concrete masonry, 6,000 cu. yd.; cyclopean masonry, 132,000 cu. yd.; stone boundary walls on outside property lines, 90,000 lin. ft.; post and rail fence and guard rails, 47,000 lin. ft.; and clearing the reservoir, 870 acres.

Mr. J. Waldo Smith is the chief engineer and Prof. Wm. H. Burr the consulting engineer for the Aqueduct Commissioners. Mr. Walter H. Sears is the engineer of the Katonah division, in which the two proposed reservoirs are located. The designs and specifications were prepared under the immediate supervision of Mr. Alfred D. Flinn in the chief engineer's office.

THE CONSUMPTION OF WATER per consumer in Fall River, Mass., averaged 36.52 gal. per day during the year 1904. An average of 56.76 per cent. of the total consumption was sold, according to the annual report of Mr. Patrick Kieran, superintendent of the waterworks, 24.53 per cent was furnished for public purposes, and the remaining 18.71 per cent. could not be accounted for.

Glass Paving Bricks.

By A. M. Thackara, U. S. Consul, Havre.

Artificial stone made from glass is manufactured in France under the Garchey patents, which are owned by the Société Anonyme La Pierre de Verre Garchey, a limited liability corporation, with a capital of $115,800, formed in 1900. Its offices are at No. 4 Rue Charras, Paris. Patents for the Garchey process have been obtained in most of the countries of Europe and their colonies, and in North and South America. The principal French companies which manufacture the Garchey artificial stone are the Carmausienne, with head offices at Toulouse and works at Bousquet d'Orb, in the Department of Hérault; La Société Parisienne d'Exploitation des Procédés Ceramiques Garchey, whose offices are at Lyon and whose factories are at Creil, Department of Oise; and Demi-Lune, near Lyon, Department of Rhône. The Garchey stone is also made in Spain, Germany and Belgium.

Old glass obtained from broken bottles, window panes, etc., is used in the manufacture of products, such as paving bricks, common tiles, etc., where uniformity of texture and color are not necessary. For the higher grades, glass is first made from sand of suitable quality, carbonate of lime, sulphate of soda and potash, the proportion being about 5 of sand, 4 of lime and 1 of alkali. After being cooled slightly the glass is granulated by being thrown into cold water. The granules are put into refractory molds and again heated to a temperature below complete fusion until they become plastic. The molds are then withdrawn from the furnace, placed under a hydraulic press, and subjected to a pressure necessary to form the plastic material into the desired shapes. After being trimmed the molds are passed through the cooling process in ovens specially constructed for the purpose.

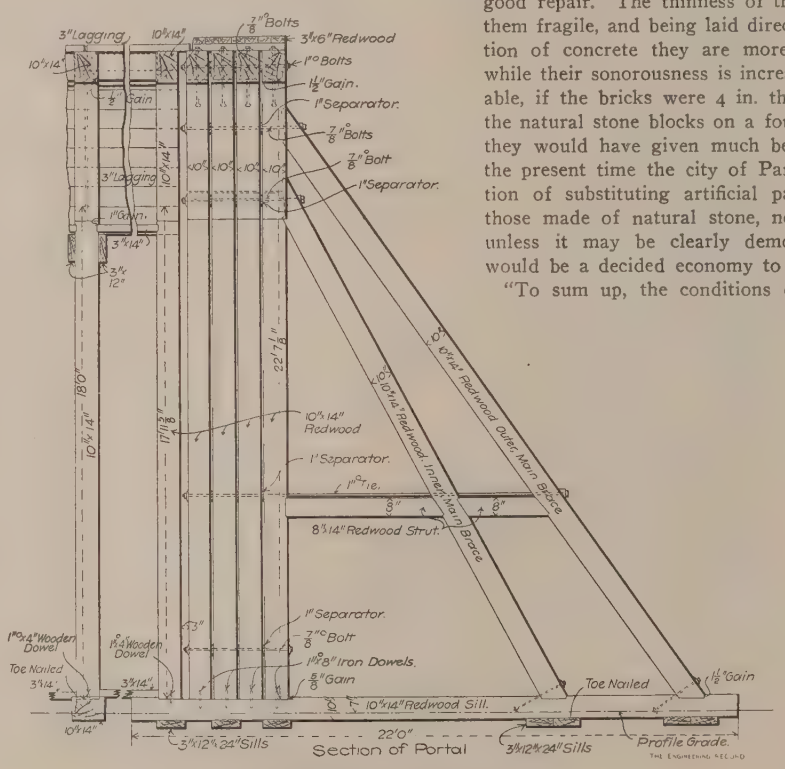
In the two operations of heating and reheating the cost of coal necessary to obtain the required temperatures is one of the factors which tend to make the production of the Garchey stone expensive. The inventor is said to have discovered another process for making the stone from glass in one heating, by which the cost is materially reduced.

The Garchey company in Paris claims that the cost of production under the old process varies from 86.85 cents to $1.06 the square meter, according to where it is manufactured, the cost of labor, the price of coal, etc., or an average of 96.5 cents per square meter. The company bases its claim upon the results which have been actually obtained in the Spanish, Belgian and French factories.

The Garchey stone is manufactured in a variety of forms for paving streets, sidewalks and gutters, and for the uses for which porcelain and other tiles are employed, as tiling the walls and floors of bathrooms, operating rooms in hospitals, waiting rooms and staircases of railroad stations, etc. As the Garchey stone has the chemical and physical qualities of glass it is not readily attacked by chemical products, so that it can be used in factories and laboratories where acids and others chemicals are employed, and being impermeable to moisture can be used in cellars and other places where there is much humidity. The stone is also molded in ornamental forms, and can be made according to the drawings of architects and interior designers for decorative purposes in drawing-rooms, offices, etc. Bricks are not used in the construction of buildings, owing principally to their cost in comparison with other materials.

In the manufacturers' catalogues many shapes and styles are illustrated. The following are the prices of tiles, bricks, etc., mostly used: Plain, smooth or fluted tiles, 7.87 in. square, or 13 in. square, about three-fourths of an inch thick, used for tiling the sides of kitchens, dining-rooms, corridors, bathrooms, etc., or flagging sidewalks, stables, passages, etc., 19 cents per square foot. Bricks, roughed or fluted, 5½ in. square, 1.57 in. thick, also 7.87 in. long, 3.54 in. wide, 1.79 in. thick, for paving purposes, 27 cents per square foot. For borders of sidewalks, gutters or for staircases: Step, fluted or roughened, 19.7 in. long, 6.3 in. wide, 21.2 cents each; riser, 19.7 in. long, 7.87 in. wide, 26 cents each; bottom of gutter, same dimensions, 28.95 cents each. For a highly ornamented tile 19.7 in. long, 13 in. wide, 63.7 cents each. The bricks, squares and tiles can be made in various colors—white, green, white and black, pink, yellow, etc. For large orders, or to architects and dealers, the manufacturers allow a discount of from 20 to 25 per cent. from the catalogue prices.

The Garchey tiles are in use for tiling the walls, floors and staircases in several of the stations of the Metropolitan Railway, of Paris. In reference to the results obtained, one of the principal officers of the railway company writes:



Section through Portal of Santa Susana Tunnel.

"Owing to the extreme hardness of these tiles (Garchey), they are not easy to cut, so it is difficult to place them in position or to redress them when they are worn. The smooth tiles become slippery, but with those that are roughened satisfactory results have been obtained. Smooth tiles are used on Line No. 1 and rough tiles on Line No. 2, the usual dimensions being 7.87 in. square and about three-fourths of an inch thick. For walls the Garchey tiles present an attractive appearance, and stand the wear and tear unusually well, but as the tiles can neither be cut nor drilled, except with great difficulty, it is not easy to hang pictures or advertisements. For the staircases it has been found that the tiles become polished rapidly, which makes them slippery when wet."

In several of the large cities of France experiments have been made with the bricks for paving purposes. At the present time the Rues Tronchet and Crimée in Paris are paved with the Garchey bricks. In reference to the experiment being made by the city of Paris, the chief of the highway department of that city writes as follows:

"The Société de Pierre de Verre Garchey was authorized to make a trial of its paving bricks made from glass in the Rues Tronchet and Crimée. The foundation for the paving is composed of a layer of concrete 5.9 in. thick, made in the proportion of 551 lb. of cement, 17.7 cu. ft. of sand, and 35.3 cu. ft. of small stones, and a layer of Portland cement 0.4 in. thick. The bricks measure 7.87 in. long, 3.74 in. wide, and 1.78 in. thick. They were laid directly on the foundation in rows perpendicular to the border, with a space between them of 0.2 in., the space being kept by a wooden template of that thickness. The mortar used was mixed in the proportion of 1,322.8 lb. of Portland cement to 35.3 cu. ft. of sand. Four days after the paving was finished the streets were open to traffic.

"Up to the present time the paving, without having given bad results, does not appear to be wearing as well as that made of natural stone. It has been noticed that alongside of the tramway rails the paving shows signs of deterioration. It is somewhat expensive to keep the streets in good repair. The thinness of the bricks renders them fragile, and being laid directly on a foundation of concrete they are more liable to break while their sonorousness is increased. It is probable, if the bricks were 4 in. thick and laid like the natural stone blocks on a foundation of sand, they would have given much better results. At the present time the city of Paris has no intention of substituting artificial paving blocks for those made of natural stone, nor in the future, unless it may be clearly demonstrated that it would be a decided economy to do so.

"To sum up, the conditions of the paving in the streets above mentioned is not such as to render it necessary to stop the experiment and remove the bricks, and it would be better to await the expiration of the three years, the period required for all similar trials, to determine the exact results."

In 1897, at the request of Mr. Garchey, the inventor of the process, tests of artificial stone, in comparison with other stones and materials used in construction, were made in the laboratory of the National School of Roads and Bridges at Paris. The main objects of the experiments were to determine the crushing strains the materials would bear and the effects of frost, concussion and wear and tear. The results of the tests may be summed up as follows:

1. The Garchey artificial stone resisted a pressure of 28,774 lb. per square inch, while granite only stood a pressure of 9,245 lb. per square inch.

2. Influence of frost: The Garchey stone was immersed in refrigerating mixtures by which a temperature of 20° below zero C. was obtained without any damage to the stone. Afterwards it

resisted a crushing pressure of 28,845 lb. per square inch.

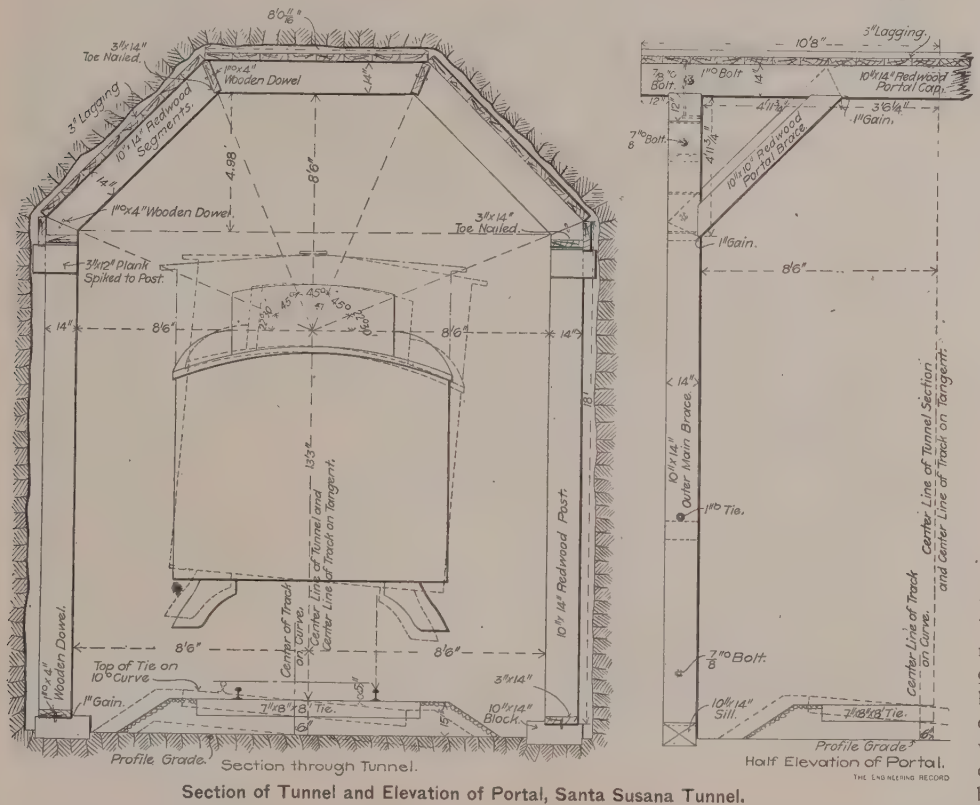
3. Wear from friction: The friction was obtained by holding the material to be tested to the face of an emery wheel at a constant pressure of 3½ lb. per square inch, the wheel revolving at the rate of 1,777 ft. in one minute. The Garchey stone was classed No. 15 in a list of 27 other materials which were subjected to the same test. The wear of the Garchey stone was 0.45 in. after 4,000 revolutions of the wheel.

4. Resistance to shock: It required on an average 22 blows of a pavior weighing 9¼ lb. in falling a distance of 3.28 ft. to break the Garchey stone, and 3 blows to make the first crack, while other materials ordinarily used for paving were broken in 19 blows.

The Santa Susana Tunnel, Southern Pacific Railway.

The Southern Pacific Co. has recently constructed a new line 59.47 miles long between Burbank and Montalvo, Cal., by which a saving of 6.97 miles is made in the distance between these points by the old route. In addition to shortening the haul, an improvement in grades and curvature has been accomplished. In the old line, the maximum grade per mile was 116.16 ft., while on the new route it is but 52.8 ft. The maximum curvature was 10 deg. on the old line and 6 deg. on the new, and the total curvature was 3,507 against 1,231 deg. at present. The length of curved track was formerly 27.6 per cent of the total length, and is 17.4 per cent. now. The total curvature, in curves sharper than 1 deg., has been reduced from 15.149 miles to 8.379 miles. The grade rise westward has been decreased from 1142.6 to 632.7 ft., and eastward from 1633.1 to 1121.8 ft.

On this line there are three tunnels, of which the Santa Susana is the longest. Its length is 7,368 ft. While it presented no unusual difficulties to distinguish it from other tunnels built by the company, it may be taken as an example of the timber-lined construction of the Southern Pacific Ry. and the accompanying illustrations of it have been prepared as showing the company's standard practice. The tunnel is on a summit with a 1 per cent. grade in one direction and a 0.1 per cent. grade in the other direction. The material encountered was nearly all red sandstone and there was some water. Progress was about 8 ft. a day, including tieups. The compressors furnishing air for the drills were run at times by electric motors, and electricity was used for lighting. The work was done under the direction of Mr. William Hood, chief engineer of the Southern Pacific Co., the contractors being Erickson & Petterson, of South San Francisco.



Section of Tunnel and Elevation of Portal, Santa Susana Tunnel.

Tests of a Sirocco Blower and a Centrifugal Pump Driven by Steam Turbines.

Tests of an interesting nature have recently been made by the Bureau of Steam Engineering of the Navy Department on a steam turbine-driven Sirocco blower and one of a turbine-driven De Laval centrifugal pump of the series type, to determine a basis of comparison with other types of similar apparatus. The blower had a 20-in. fan with double inlets and discharged at one side of the casing. It was mounted on a common bedplate with the turbine, and direct-connected to its reduction shaft. The centrifugal pump was of the series type, with two entirely independent casings with impellers, of the De Laval Co. and driven by a turbine having two reduction shafts, each of which drives one of the pump impellers, the discharge of the first pump delivering into the suction of the second.

The fan was tested by the usual method of discharging the air into an air-tight receptacle with a well-rounded discharge orifice. The velocity heads of the outflowing air were measured by small Pitot tubes indicating the pressure at various points within the receptacle and also in the orifice, from which averages were determined. From these the air delivery was calculated by formula and also the air horsepower of the blower. After completion of the blower tests, the blower was removed and brake tests of the turbine performed, under conditions similar to those of the blower tests. This was accomplished by loading the Prony brake until the steam gauge below the governor valve registered approximately the same pressures as during the blower tests. The turbine speed as well as also the number of nozzles open was adjusted to conform. The steam consumption of the turbine was predetermined for both cases by independent tests upon the nozzles, from which the consumption in each nozzle could be calculated directly from the inlet and outlet pressures.

The blower set was run at two loadings, in order to obtain results covering normal and reduced outputs. The brake horse-powers of the blower, deduced from the total steam consumed and the steam per brake horse-power, was found to be 63.54 hp (full load) and 22.98 hp. The air horse-power, which is equivalent to the energy expended upon the air discharged, was found to be 34.45 hp and 10.81 hp, giving thus efficiencies of the blower of 54.2 per cent at normal output and 47.05 per cent. at reduced output. The steam consumption of the turbine per air horse-power hour respectively was at the rate of 42.09 and 58.28 lbs. per hour in the two cases.

The series centrifugal pump tested was one built for Jones & Laughlin, Pittsburg, Pa., for service in a local fire system within their works. The rated capacity of the pump was about 10,000 gal. per minute, with a 30-ft. lift, but on account of the limited capacity of the testing tanks available, the pump was run discharging one-half this quantity against double the head (60 ft.), the average water horse-power being equivalent in both cases. The tests were carried out in a manner similar to that pursued in the blower tests, Pitot tubes being used to obtain the pressures of suction and delivery, and the orifice having been made a converging nozzle of such a shape that the loss due to contraction at the outlet was negligibly small.

The water discharge was calculated by the formula, $Q = C \times$ nozzle area $\times \sqrt{2gH}$, C being assumed at 0.95. Four tests were made with the pump in operation and four with pump disconnected, and replaced by a Prony brake to determine the brake horse-power; in each set two tests were made at a speed of about 1,200 r.p.m., both condensing and non-condensing, and two more under similar conditions at a speed of about 975 r.p.m. The water horse-power transmitted by the pump was calculated from the total weights of water lifted and the total head operated against, which was determined by adding the suction and discharge heads. The power delivered by the turbine under corresponding conditions was measured by Prony brake tests and the steam consumptions by methods similar to those used in the blower tests. The efficiency of the pump was, of course, in each case found in the ratio of the water horse-power to the brake horse-power. The principal results of the four sets of tests are presented in the accompanying table:

TESTS OF STEAM TURBINE DRIVEN PUMP.

Operating condition.	Pump: Speed r.p.m.	Pump: Water discharge gal. per min.	Pump: Water horsepower.	Pump: Efficiency per cent.	Turbine: Brake horsepower.	Turbine: Steam, lb. per b. h. p. hr.	Turbine: Steam, lb. per water hp. hr.
Condens'g	1210	5,110	76.7	72.1	106.3	16.95	24.64
	970	2,640	42.	62.3	66.3	18.1	26.57
Non-Condens'g	980	2,660	43.3	61.7	70.1	34.2	56.12
	1210	5,120	77.1	71.6	108.2	31.7	45.15

These tests were made by A. B. Canaga, Commander, U. S. N.; H. C. Dinger, Lieutenant, U. S. N., and Ernest N. Janson, of the Bureau of Steam Engineering, Navy Department. The full report appeared in the February, 1905, number of the "Journal" of the American Society of Naval Engineers.

Ice Elevators at the St. Louis Water Works.

By E. E. Wall, Assistant Water Commissioner.

The presence of anchor or needle ice in the wet well at the Chain of Rocks has been a source of great annoyance and expense to the Department almost every winter since the station was put in operation in 1894. The gratings over the gate openings in the intake tower, while preventing the ingress of large pieces of ice, could not be made close enough to keep out the needle ice, which is almost as fine as snow. This needle ice seems to begin to form in the river whenever the thermometer falls below 20° F., and is drawn in through the tunnel to the wet well and thence to the pumps. It rapidly accumulates in the wet well, and if not removed would fill up the entire well and tunnel, becoming more and more compact because of the water pressure from the tower, until little or no water would reach the pumps. There have been times when the obstruction to the flow of water threatened to interfere very seriously with the water supply of the city, and every winter brought its time of worry and the continual apprehension of serious trouble.

In 1900, under the direction of Mr. S. Bent Russell, at that time Principal Assistant Engineer of Water Works Extension, an elevator was designed and built on the south end of the wet well. This proved very satisfactory, and the elevator was used until the winter of 1904, when, on Jan. 30, the chain became wedged by a log which in some unaccountable way had been drawn through the tunnel into the wet well. In attempting to disentangle it, the chain was broken. The river was very high for the time of the year, and full of ice. In a few hours the well was filled with ice to the depth of 20 ft., the flow of water greatly cut down, and the Department confronted with the most serious danger from ice interference in its history. With every stroke of the pumps this mass of slush ice in the wet well, some 20 ft. thick, 150 ft. long, 10 ft. wide, moved up and down from 2 to 5 ft. This continual movement soon racked and bent the framework of the ice elevator beyond all hope of repair, until such time as the well could be emptied, which could not be done until warm weather. A boom derrick was hastily erected at each end of the wet well, and preparations made for hoisting the ice in boxes, dumping it on the surface and hauling it away with teams and drag scrapers. For eight days 150 men were employed in shoveling ice in boxes, hoisting and clearing away. The work was kept up continually, the daily force being divided into three shifts of eight hours each. The derricks were operated by double-drum hoisting engines, averaging 10 trips per hour, carrying approximately 1 cu. yd. of ice per trip.

On Feb. 6, the well was clear of ice, but four days later ice began coming in again, and from Feb. 11 until Feb. 22, men, teams and engines kept up the continuous labor of clearing away ice. Two small mountains of ice remained as souvenirs of the occasion until the summer sun melted them away.

During the summer of 1904, the ice elevator was repaired, and another one built at the other end of the wet well. This last elevator has some improvements over the old one, and the accompanying drawings show the new design.

The old elevator is run by an 8x10-in. double engine, and the new one by a 10x12-in. double engine. It requires about 30 h.p. to operate each elevator. The buckets move at the rate of 50 ft. per minute, each bucket holding about 5 cu. ft. There are thirty buckets spaced about 5 ft. apart. As each bucket passes over the upper sprocket wheel it dumps into a chute which empties into a manhole over a 20-in. drain leading to the river. These drains are flushed by continuous streams of waste water from the engine house, which supply can be increased through pipe connections to the filling conduit. When the elevators are in service, it is necessary to keep a few men in the wet well to move the ice to the elevator buckets.

It would easily be practicable to design machinery to automatically remove the ice entirely from the wet well, if the conditions justified it. But the infrequency of the occurrence and the usually short duration of the trouble make it altogether unlikely that any further installation of machinery would be economical.

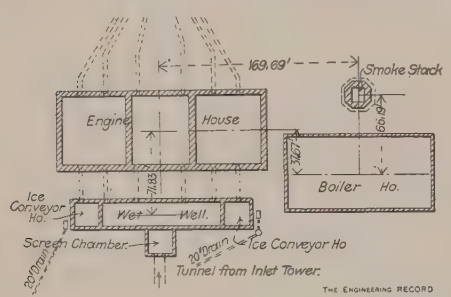
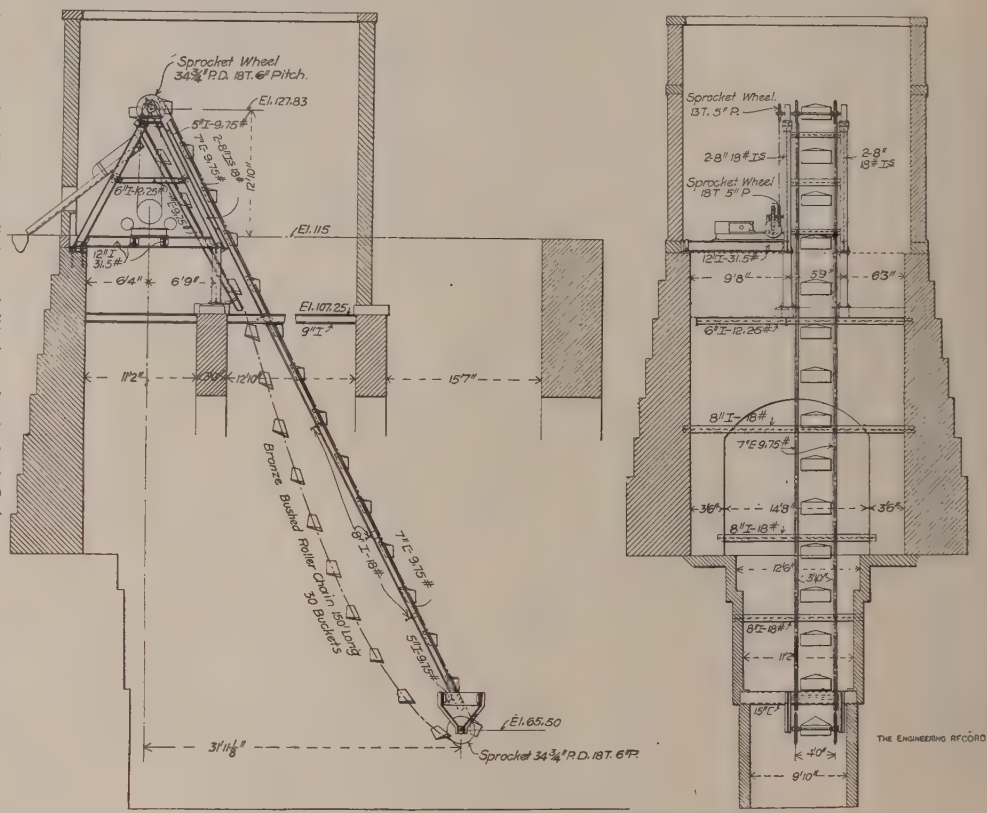
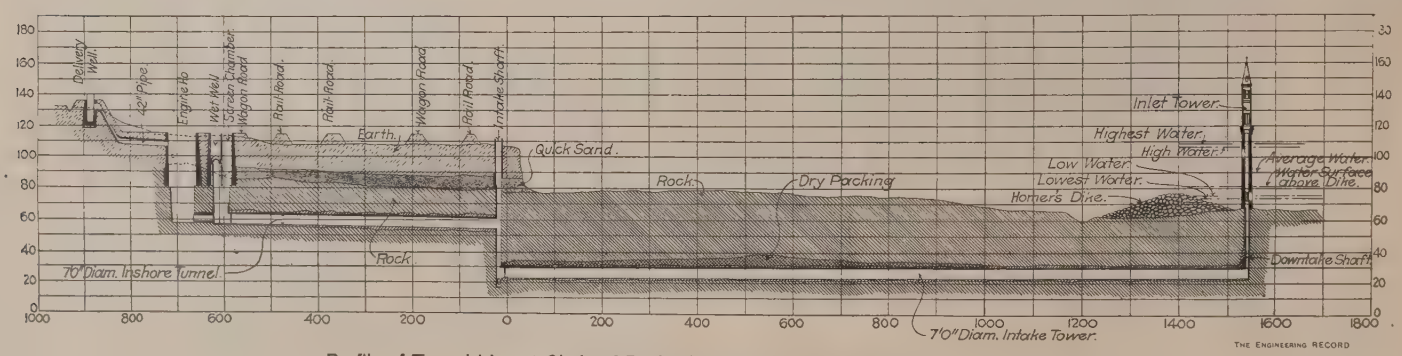


Diagram of Location of Ice Conveyors.



Elevations of Ice Conveyors in Wet Wells at Low Service Station.



Profile of Tunnel Line at Chain of Rocks, Low-Service Extension, St. Louis Water Works.

A Special Lecture Course has been arranged for the senior students at Stevens Institute. After the final examinations, six weeks of thesis work remain in the college year, and four hours a week will be reserved for lectures by a number of eminent specialists. These will cover telephone practice, ship propulsion, business features of engineering practice, patent law, civil and electrical engineering subjects not covered in the school course, the advantages of system in conducting work, and other topics.

The Necaxa Plant of the Mexican Light & Power Co.

By J. L. Bothwell.

It is doubtful if there are any power plants being constructed at the present time that are of more engineering interest than that of the Mexican Light & Power Co., at the falls of the Necaxa River in Mexico. Situated in a very wild part of the country, nearly one hundred miles from the base of supplies, the work that has been accomplished there reflects great credit on the men in charge, as well as those who conceived the project. When it is considered that it was necessary to construct a wagon road more than 56 miles over mountain and plain, some 30 miles of which was of very difficult engineering, some little idea may be had of the hardships that had to be overcome in carrying out this work.

There are two rivers of practically the same volume that run in parallel valleys, one river being somewhat more elevated than the other. These are the Necaxa and the Tenango. They are quite large and have their source in the high plateau of the Valley of Mexico, about 7,000 ft. or more above the sea level, and in their course to the sea they leave this plateau in a series of falls and cascades. At the point where they emerge from the plateau the mountains come together and almost meet, forming an almost ideal spot for a power plant. The Necaxa River runs for some distance in a valley bounded by precipitous bluffs and mountains, forming a natural impounding district for the purpose of the company.

At the point of convergence of the mountains, there has been built an earth dam with a concrete core about 140 ft. high. This dam is nearly one-eighth of a mile long on its crest. The Tenango River is somewhat higher than the Necaxa, and the idea was conceived to drive a tunnel through a range of mountains and divert the water from the Tenango River into the valley of the Necaxa. The tunnel thus driven has a width of 10 ft. on the floor and is 7 ft. high; it is about 3,470 ft. long. At the end where the waters are taken from the Tenango River it was necessary to make an open cut about 180 ft. long. The Tenango River was dammed below its confluence with its two principal branches and the whole volume of water was diverted through this tunnel to the Necaxa River.

In carrying out this extensive scheme the company was required to buy up entire three villages, Palotecoyo, San Miguel and Necaxa, which will be submerged to a depth of not less than 125 ft. The enormous amounts of water that will be impounded in this basin when filled to the different heights above sea level are shown in the following table:

El. 1,320 m. above sea	4,327,965,880 gal.
El. 1,325 m. above sea	6,082,570,920 gal.
El. 1,330 m. above sea	8,111,366,160 gal.
El. 1,335 (high-water mark)	10,381,427,640 gal.

Through one of the rocky spurs that jut out into the valley at its outlet, there has been bored a tunnel through which two steel pipes have been laid to conduct the water to the wheels 1,440 ft. below in a great chasm near the foot of the second fall and some 4,530 ft. distant from the dam. Here will be located plant No. 1 with six wheels with a rated capacity of 7,000 h.p. each. The discharge from these turbines will, in the future, be gathered behind a small dam about 1,000 ft. below power plant No. 1, and thence carried through another tunnel 9,200 ft. down to a second power house, where other wheels of a rated capacity of 42,000 h.p. additional will be installed. The fall of water on the second wheels will be approximately 1,210 ft.

The generators in the power stations running at 300 r.p.m. will deliver fifty-cycle, three-phase current to step-up transformers at 4,000 volts; the transformers in turn will deliver current to the line at 60,000 volts maximum.

It is the intention at present to run two and perhaps three independent trunk lines to the City of Mexico, each with a capacity of 20,000 hp., the desire of the company being to fortify itself so that it may insure a reliable current all of the time. The conductors, supported by steel towers placed about 450 ft. apart, will be run on specially designed insulators of very large size.

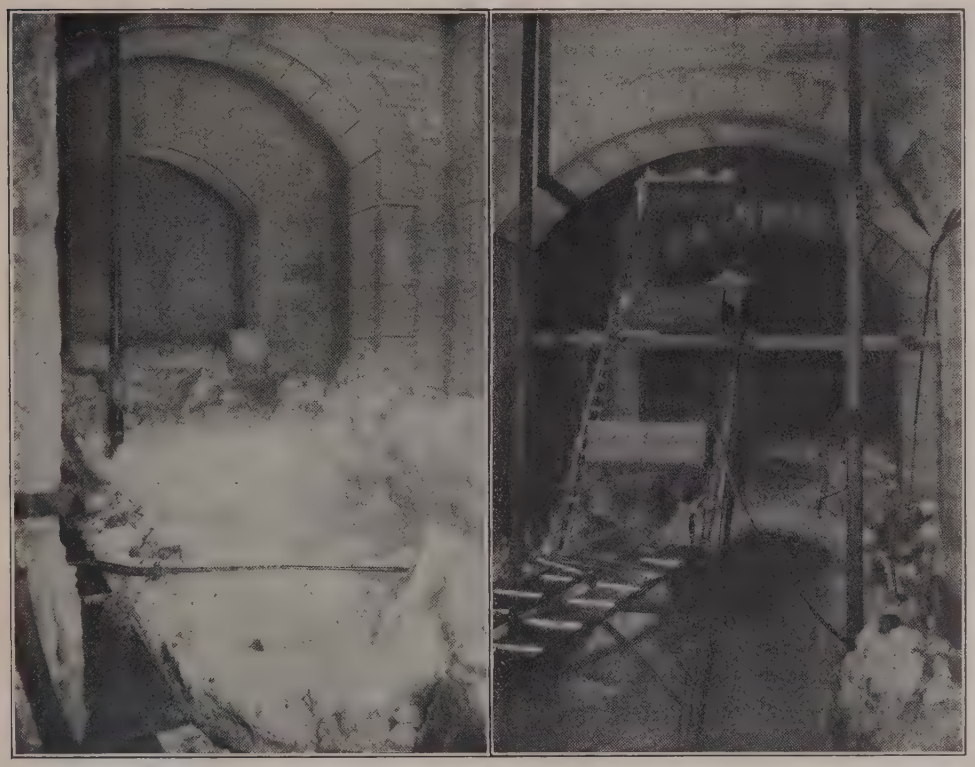
The steel pipes leading from the dam to the wheels are for the first thousand feet or so 8 ft. in diameter and of 3/8-in. steel, and for the remaining distance they are 6 ft. in diameter and of 29/32-in. steel. At the end of the 6-ft. pipes there is a header from which there are six 36-in. pipes leading to the wheels. The course of the river below the main dam is very tortuous and as the pipes are laid substantially in a straight line it has been necessary to carry them over the river on masonry piers, through open cuts in the small ridges and spurs, and in several instances in short tunnels through the larger ridges and spurs of the mountains.

A temporary power plant to furnish compressed air and power for the electric hoists and pumps has been installed at the foot of the first falls on the Necaxa. In the power house, in addition to an air compressor, direct driven by a special Pelton wheel, are two 50-kw., 500-volt General Electric generators driven by Pelton wheels, which furnish light throughout the works, camps and the tunnels and current for the many hoists and pumps employed in the excavating as well as in the large and well appointed machine shop. In addition to other apparatus already furnished by the General Electric Co., it has been awarded the contract for the fifteen 2,000-kw. step-up transformers and the sixteen 1,800-kw. step-down transformers, with complete switchboards for the generating station at Necaxa and the distributing station in Mexico City.

The transmission towers are of galvanized steel of light construction, well braced and riveted together to make them rigid and strong. They consist of four corner posts in pairs, each pair forming a triangle spaced about 8 ft. apart and connected with pipe tube at the top. This tube is about 12 ft. long and projects about 2 ft. over each end. At either end and in the center of this cross arm are placed the insulators, about 6 ft. apart. These towers are very easily erected and need no guy wires, as they are placed in the ground sufficient distance to insure their rigidity.

The developments at Necaxa were actively begun in the summer of 1903 and it is the intention of the company to have its wires in the City of Mexico during the early part of 1905. About 2,300 men were employed in building the new road, driving the tunnels, erecting the dams and preparing the foundations for the power house. The installation of the first power house involves the transportation of nearly 35,000 tons of machinery, cement and other construction materials over the road alluded to, which has been built from Santiago, on the Hidalgo R. R., to Necaxa. For moving the vast amount of material, two traction engines are in constant service, besides a great number of mule trains and pack animals. There was some doubt about the economy of the traction engines, but after careful analysis of the charges per ton of freight hauled, a saving of 40 per cent. under existing circumstances was shown. In some instances the grade is quite heavy, but the traction engines very often carried loads of 30 to 33 tons per trip. A narrow-gauge railroad is now being built from the connection with the Hidalgo R. R. to the site of the plant.

The company has contracted to deliver power in the City of Mexico, where it is at present running a steam plant of 5,700 hp., to many cotton and flax mills, for street lighting, to street railways and to many other plants requiring power. It has also contracted for power to be delivered to the many mines to the north and east of the City of Mexico, as well as to the many ranches which will use it for irrigating purposes and lighting.



Views of the Ice in the Wells and of One of the Elevators, St. Louis Water Works

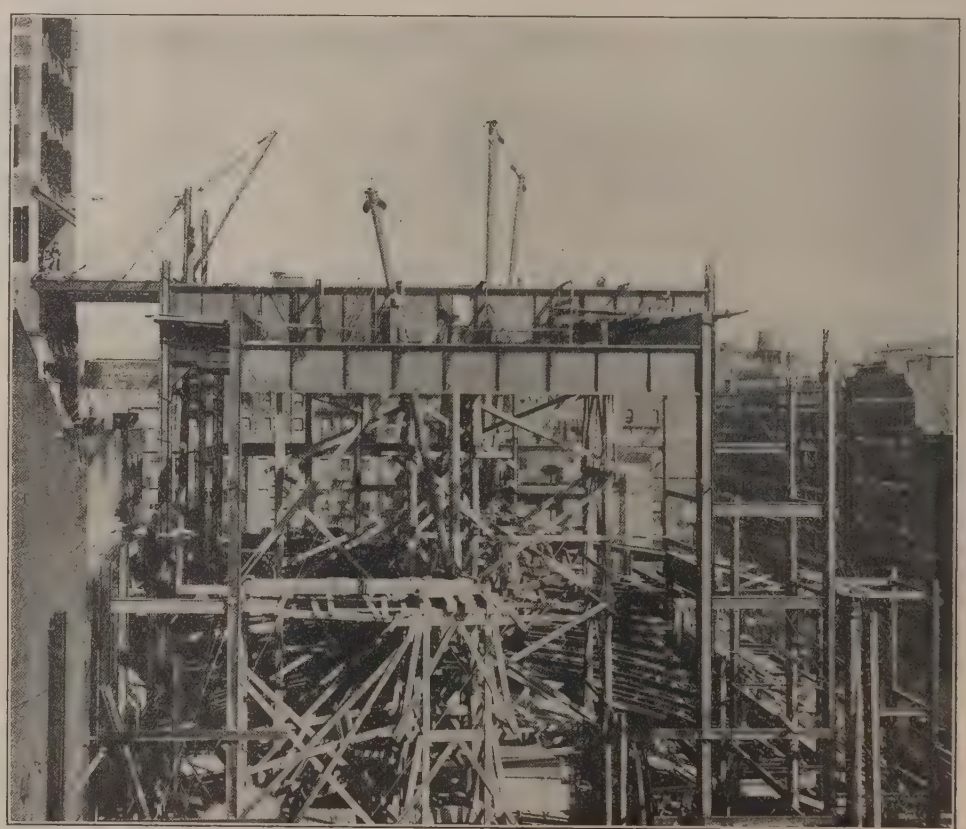
The Erection of the New Amsterdam Theatre, New York.

The New Amsterdam Theatre, at 41st and 42d Streets, New York, is about 100 ft. wide, 150 ft. long and 140 ft. in height above the curb, and contains about 1,360 tons of structural steel in the columns and girders of the theatre proper and 350 tons in a 25x100-ft., 11-story office building connected with it. The theatre part is a double-deck structure with a roof garden, stage, balcony and dressing rooms above the main auditorium, and the latter's complement of similar rooms. The dimensions of the auditoriums and stages are large, and the unobstructed areas are so great that the heights of the columns and the weights of the main girders are unusually large and the steelwork presents some interesting features in the design and erection. The former was illustrated in The Engineering Record of November 19 and 26 and December 3, 1904. Some of the latter are shown in this article.

The roof of the roof garden has long-span girders and trusses, which support only the ordinary roof load and a portion of the balcony. The heaviest construction is in the floor of the roof garden, where the 42-ton main transverse plate girder, about 83 ft. long and 12 ft. deep, spans the auditorium at a height of about 75 ft. in the clear above the basement floor. This girder carries a large portion of the loads for the floor of the roof garden and the suspended ceiling and gallery of the main auditorium. It is seated on solid-web knee braces which give it additional connection to the main columns. It is made with web plates ¾ in. thick and 6x6x⅞-in. flange angles with both vertical and horizontal legs reinforced by heavy plates. All of these materials were shipped separately from the bridge shops, where they had previously been assembled and marked, and the girder was reassembled at the site on falsework of ordinary square timber made like bridge falsework and braced as shown in the accompanying illustration.

The columns which support the girder are of the Gray pattern, made with twelve 6x4 and 6x6 in. angles and a pair of 15-in. channels with reinforced webs, having a total cross-section of over 153 sq. in. for a maximum stress of 1,234,000 lb. direct compression. The column below the girder was shop-riveted in three lengths, the lowest one having a weight of about 8 tons. All material was received on trucks and unloaded by a stiff-leg derrick, which delivered to a 20-ton guyed derrick situated near the center of the building and commanding the entire area. This derrick had a 65-ft. mast and a 56-ft. boom, which in handling the roof girders was lengthened 14 ft. by splicing to it another boom. The two pieces of timber overlapped several feet and were packed with wooden fillers carefully concaved to fit both sides of the round timbers. Transverse steel pins through the adjacent ends of the timbers projected far enough on both sides to receive four turns of a 1-in. steel cable wound back and forth with the ends fastened together by means of ordinary clamps. These give a total of eight parts of rope acting directly in tension to transfer the load from the extension to the main boom, besides which some frictional resistance was developed by wire rope lashing at both ends. With this splice the boom was considered good for a load of 14 tons at the extremity. The derricks were operated by Lidgerwood and Mundy hoisting engines which were at first located in the basement and afterward moved to the street. The derrick was secured by twelve steel rope guys set at such an angle that it was sometimes necessary to temporarily release one guy in order to pass the boom across it. Materials for the large plate girder were handled by a small traveling derrick at the level of the roof-garden floor and all the field rivets in it were driven by Boyer pneumatic hammers. Ten of these were installed and were operated by air from the 4-in. vertical standpipe near the center of the building, which was extended story by story as the different tiers were erected. All of the riveting was completed for each story before that on an upper one was commenced, so that only one outlet was used from the standpipe at any given time. The air was compressed by an Ingersoll-Sergeant machine operated by a locomotive boiler.

The next heaviest members were a pair of open-web girders in the roof. They were about 55 ft. long, 10 ft. deep and weighed 28,000 lb. each. They were shipped whole from the bridge shops and delivered to the building on a 6-horse truck. The boom of the 20-ton derrick handled them at long radius, lifting them by a single hitch above the center of gravity. These trusses were flexible transversely and were temporarily stiffened against erection stresses by reinforcement timbers lashed to their top and bottom chords.



Assembling Girder in Roof Garden Floor 75 Ft. above Foundations.

In order to handle the 10-ton trusses over the stage the 65-ft. boom of the stiff-leg derrick was reinforced by timbers bolted to the sides and by hog-chaining. The steelwork was erected by an average force of 150 men in 90 days.

J. H. Gray & Co. were the engineers for the structural work, which was fabricated in Belgium, except the large girders here described, which were made at the Trenton and Empire plants of the American Bridge Co. Herts & Tallant were the architects and the general contract was awarded to the George A. Fuller Co., who also erected the steelwork under the direction of Mr. Louis R. Barras, superintendent.

A 12-H.-P. Gas Engine running at an expense of a trifle over 1 cent per brake horse-power was mentioned by Dr. F. H. Bowman at a recent meeting of the Leeds section of the Institution of Electrical Engineers. This engine was in regular work, and the cost of operating included the expense of running a suction gas producer, wages, fuel, stores, depreciation, rent and taxes.

Recent Additions to the Worcester City Hospital Plant.

By H. S. Knowlton.

A number of notable additions to the power plant equipment of the Worcester (Mass.) City Hospital were made during the past year. The hospital is now composed of 17 buildings, 12 of which have been added during the last 24 years. The old power plant occupied a building of brick construction, and consisted of 2 Manning boilers, rated at 125 h.p. each; a 75-kw. generating set, composed of a compound-wound Westinghouse dynamo, direct driven by an automatic 10-in. x 18-in. x 10-in. Westinghouse vertical single-acting engine; a 15-kw., 125-volt Lundell generator direct-driven by a Chandler & Taylor single cylinder slide valve engine, and a two-panel slate switchboard. The erection of five new buildings, two additions and some remodeling and renovation work in 1904 led to an increase in the power plant equipment under the general oversight of Mr. George I. Rockwood, of Worcester. The power house building was extended 18 ft. to the north to enable the new machinery to be added.

In brief, the new equipment consists of two 150-h.p. Manning boilers, a 125-kw. Westinghouse generating unit, and a 12-ton refrigerating plant made by the Remington Machine Co., of Wilmington, Del. The two new boilers are used exclusively for heating, and the two old ones are used for power purposes. Live steam under a pressure of from 8 to 10 lb. is employed for heating during the greater part of the year, and is conducted through an 8-in. main in a subway, whence it is distributed in smaller pipes through the basement corridors to the various buildings. The indirect system of heating is used. The fans for this work are driven by 110-volt motors. There are also fans and ducts for the extraction of foul air from the various wards and buildings. There are over two dozen motors of ½ to 2 h.p. each in service driving fans. Anemometer tests have shown that sufficient air passes through the wards to supply each patient with 4,000 to 8,000 cu. ft. an

hour, depending upon the speed at which the fans are operated. Medical authorities are agreed that from 3,000 to 5,000 cu. ft. per head per hour will meet the requirements of ventilation in a general hospital, so that the Worcester system appears amply designed. The Johnson Electric Service Company's automatic heat regulating system is in use, and it satisfactorily controls the temperature within a variation of 3° in the coldest weather. Compressed air at 20 lb. per sq. in. is used to operate the dampers. All the fans and motors are located in the basement, with the exception of one in the attic of the pathological building.

Each of the new Manning boilers has 210 tubes, 2½ in. in diameter, and the new equipment includes a 4½x2¾x4-in. Warren duplex feed pump and a receiver for the heating system returns. The 125-kw., 125-volt generator is driven by a 13x22x13-in. Westinghouse vertical compound engine at 300 r.p.m., steam pressure 120 lb. The new switchboard panel is a 5x3 ft. x1¼-in. slab of slate, and protruding into the laundry washroom, so that clothing can be entered at one end and taken out at the other. This arrangement prevents germs from reaching the laundry where other clothing might be contaminated. The clothes are handled in a car, which runs into the laundry on tracks. Previous to the installation of this plant it was never absolutely certain that the methods of disinfecting large articles, such as mattresses, were above suspicion, and the labor involved in obtaining even these questionable results was great. The new plant is greatly superior to the older methods which were practised.

An interesting application of a motor occurs in connection with the autopsy room. The autopsy table consists of a standard of white enameled iron supporting a table, which revolves on ball bearings. Extending over the table is a movable crane by which hot and cold water is furnished at whatever point desired. The floor is granolithic, with a drain, and a circular group of seats is provided for the use of students and physicians. The table is ventilated downwards by a 24-in. fan driven by a ½-h.p. motor, so that all disagreeable odors are removed before they can be disseminated through the room. Other uses of motors are for driving a brine pump, ice cream freezer, a small machine shop, two X-ray machines, ½ and ¾ h.p., a carpenter shop buzz planer, circular saw and grindstone, and a small motor generator for the telephone system. Current for medical purposes is also drawn from the plant and transformed by an induction coil. Numerous small fans driven by motors are in use for ventilation of private rooms, etc., and electric heating pads, laundry flatirons and body ironers are in service. A private branch telephone exchange has been installed in place of the intercommunicating system formerly employed. Altogether some $313,000 was expended in improvements during the past year, and the additions to the power plant equipment bear witness to the importance of the engineer's work in perfecting the modern hospital.

Falsework for Erection of 83 Ft. Plate Girder, New Amsterdam Theatre.

the present connected load is not far from 2,000 16-c.p. lamps. For the supply of compressed air an Economical refrigerating machine is used.

The new refrigerating plant was installed by C. W. Boyer, of Somerville, Mass. It employs a compressor and condenser located in the engine room, the expansion coils being located in the kitchen and the morgue. The direct system of expansion is used, the expansion coils being located near the ceiling of the morgue, while in the kitchen the brine system of circulation is employed. About 1,000 lb. of ice are used daily. The pressure used on the ammonia system is about 155 lb. per sq. in. In the laundry, adjoining the engine room, a steam sterilizer has been installed, made by C. Stewart & Sons. It consists of a wrought-iron steam cylinder, with inner and outer shells forming a steam jacket, which is filled with steam during the process of disinfection, preventing too rapid condensation and consequent wetting of clothing. The sterilizer is 5 ft. in diameter and 7 ft. 4 in. long, with a door at either end. It is built in the wall, with one end

Checking Electrolysis in Los Angeles.

The water department in Los Angeles, Cal., and the Los Angeles Railway Co. have made a combined attempt to prevent the electrolysis of the cast-iron mains in the city water-works by return current from electric street railways. It was found that bonding the mains to the rails protected the service connections, but caused corrosion at the joints in the mains. It was considered that if all the joints were of insulating material the main would be self-protecting, as there would not be sufficient difference of potential at the individual joints to cause current to flow around, either through the water in the pipe or through the earth outside of it, unless the earth was unusually acid. The difference in potential between the pipe and the rail could thus be materially reduced, Mr. E. F. Scattergood says in discussing in the Sibley Journal of Engineering, the students' journal of Cornell University, the experiments that were made. The resistance of the pipe line as compared with the path through the earth from pipe to rail and from rail to pipe, he says, would be increased in this manner, and, if necessary, the service pipes could be protected by bonding the mains to the rails.

A length of 752 ft. of 6-in. cast-iron pipe was laid with cement joints on a street leading from the street on which the street railway power house is located. It was continued with 692 ft. of the same pipe with the usual lead joints, and was laid within a foot of an old main, and covered with moist earth, but without any metallic connections. The pipe was then filled with water and the two sections bonded together. The end near the power house was also bonded to the rail of the tracks in the street above it, and the opposite end was bonded to the rail at that point.

Tests made to determine the results showed that in approaching the power house there was 1¼ volts drop in each 100 ft. of the section with cement joints, and but 1 to 3 amperes current flowing in the bond at the power house end, which, Mr. Scattergood states, probably leaked from the old main to the end section of the new one. The 1¼-volt drop per 100 ft. is twice the drop per 100 ft. found in any of the rails in the city, and the difference in potential between the ends of the section with cement joints, Mr. Scattergood says, was evidently equal to a rail drop of double the distance plus the drop in the lead-joint section due to reverse current in it. The leaded section was tested at the same time, and the current flowing in it was found to be 40 amperes. This flowed to the bond with the rail at the distant end of the section, and then back through the rail to the power house.

The center bond joining the sections of the main with the different types of joints was afterward connected through a resistance to the trolley wire. Tests made then showed 120 amperes flowing in the lead-joint section, but only the same 1 to 3 amperes in the bond at the end of the cement-joint section near the power house, although the tendency was in that direction.

The cement joints, as applied, have proved successful, although no care was taken to prevent contact in the socket joints when cemented, and Mr. Scattergood is of the opinion that they should be favored. A 20-in. water main, laid with cement joints, is in operation under 40-lb. pressure in Los Angeles, and gas mains in San Francisco, laid in the same manner, have been successfully operated for a number of years.

A Gasolene Motor Railway Car for light freight and passenger service was recently completed in the shops of the Union Pacific Ry. and will be subjected to an extensive service test. The car recently made a 154-mile trip at an average speed of 27.5 miles an hour.

Details of Blackwells Island Bridge Superstructure.—I.

The five-span cantilever bridge across the East River and Blackwells Island, New York, from East Fifty-ninth St., Manhattan Borough, to Ravenswood, Queens Borough, will have a total length of 3,724 ft. for the main spans, and will contain about 86,000,000 lb. of steel. It will be 90 ft. wide, and will have two decks designed to ultimately carry eight railroad and street car tracks, a carriageway and two sidewalks. There will be two lines of pin-connected trusses in vertical planes 60 ft. apart on centers, 185 ft. in maximum depth, arranged in two main cantilever spans of the full channel widths, one connecting span across the island and two anchor spans on shore, all as indicated by the general elevation and cross section diagrams published in this journal March 4. The structure has been designed, and its construction is directed by the Department of Bridges of Greater New York, Mr. Geo. E. Best, commissioner; Mr. O. F. Nichols, chief engineer, and Mr. R. S. Buck, consulting engineer. The contract for the superstructure has been awarded to the Pennsylvania Steel Co., Mr. J. V. W. Reynders, superintendent of the bridge and construction department.

Erection will soon be commenced with the connecting span over Blackwells Island, and the detail designs for it have been completed by engineers for the city and for the contractor, the latter preparing the shop drawings in accordance with the general design and specifications, and in frequent conference with city engineers in order that all the requirements may be observed, and that provision shall be made at the same time for the most efficient shop work, simplicity of construction and for such features of the members and their connections as shall promote the rapidity and safety of erection. These considerations are of great importance in view that the members dealt with are of dimensions and weights entirely unprecedented in bridge shop work or in the erection and field assembling of completed units. Great care and skill have been exercised to keep the materials within commercial limits, to conform to advanced standards of construction, to restrict the shop operations to the known capacity of existing or special plant, and to provide for the handling, transportation, accurate finish and final assembling in place at great heights of members more than twice as large as have been before used of the same kind.

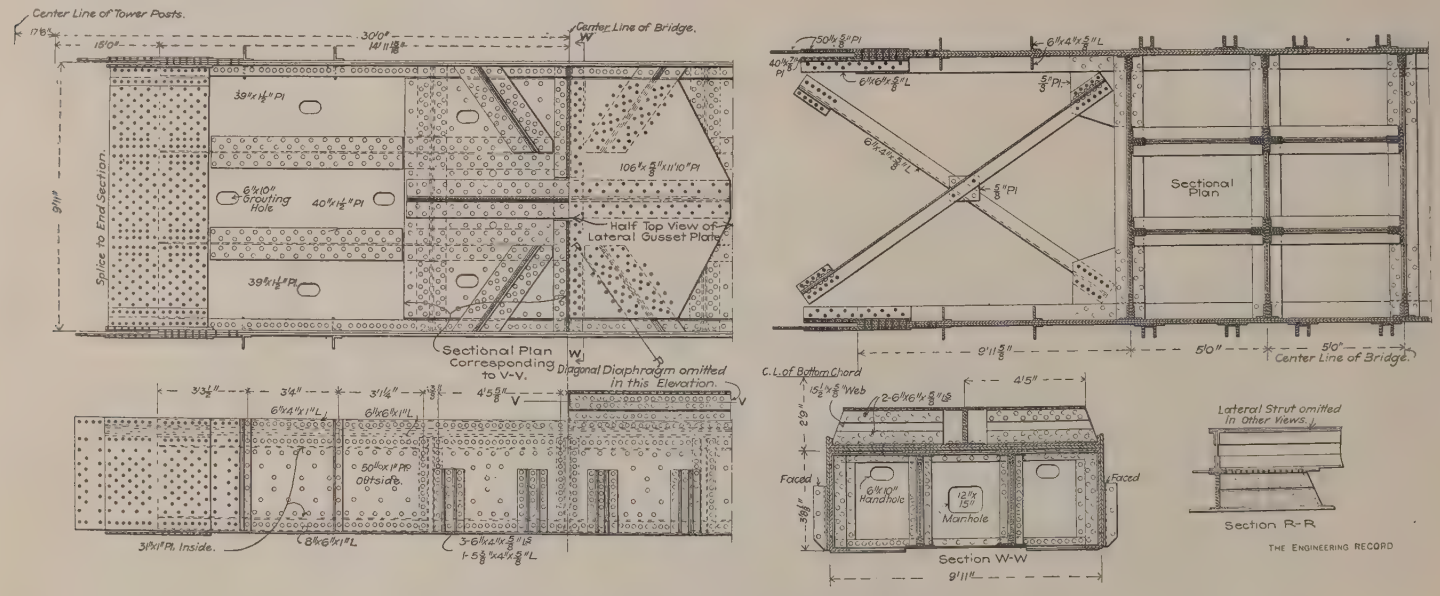
The island span is part of a continuous superstructure 1,713 ft. long which is supported on piers 2 and 3, and overhangs them with cantilever arms forming halves of the river spans. Its trusses are 630 ft. long, between centers of piers, 118 ft. high in the middle and 185 ft. high at the piers, where the main posts diverge from the vertical planes of the trusses, and are battered transversely, forming massive single bents instead of towers. These bents are independent of the lower chords of the trusses, and transmit only wind stresses and the vertical components of the top chord stresses to the piers. They have no longitudinal bracing, but are thoroughly braced transversely, as shown in the elevation. The bents have different stresses and cross sections on piers 2 and 3, on account of the different lengths of the adjacent river spans and the fixed and expansion connections, but their general dimensions and most details are the same, and are illustrated by the description given, which is for the bent on Pier 2.

The bent is about 198 ft. high, exclusive of the ornamental work, 112 ft. wide at the base, over all, and weighs about 2,650,000 lb., exclusive of the cast-steel pedestals. The two main posts are the most massive members of the bridge, and are about 174 ft. in extreme length, have a uniform width of 64 in. transverse to the bridge axis, and are from about 7 to 10½ ft. wide longitudinally. Each post is shop-riveted in nine sections of nearly equal length, the heaviest piece having an erection weight of 120,000 lb., and a cross sectional area of 1,250 sq. in. The posts are seated on compound cast-steel pedestals, and have 62-ton riveted shoes at the top to receive the connection pins for the eyebars in the top chords and diagonals. All other connections in this bent are field riveted with 1-in. rivets by pneumatic hammers.

Each pedestal is made in three courses, and is proportioned to extend the bearing to an area of about 295 sq. ft. on the pier masonry, and thus reduce the pressure there to about 60,000 lb. per sq. ft. The upper two courses are single castings and the lower course has two 17 ft. 2-in. by 8 ft. 7 in. castings united on the longitudinal axis of the bridge by 20 2½-in. turned bolts through planed bearings faces on the vertical webs. Each casting in the pedestal has top and bottom plates with planed bearing surfaces and vertical and inclined longitudinal and transverse connecting webs from 15 to 24 in. apart in the clear. Rectangular holes are cored in the centers of the horizontal panels and round holes in the webs to allow for the proper support of the cores and the removal of the core sand. The general thickness of the metal is 2¾ in., all fillets have a radius of 2 in. and all metal is annealed cast steel.

Each of the main posts receives a total maximum load of 23,770,000 lb. due to the dead load of the bridge and the assumed live loads of 8,000 lb. per lin. ft. regular and 16,000 lb. congested, and to a comparatively slight stress from the top laterals. This requires a cross sectional area of 1,250 sq. in., which is provided, and each post is also trussed by an inner member and zig-zag bracing to resist all transverse stresses, and with the double top transverse members, to be strong enough to have lateral stability under heavy wind pressure without the lower portal and panels of X-bracing when the latter are removed, as they will be, and kept out for several days, perhaps, to allow the erecting traveler to pass through from the island to the river span.

It is assumed that 10 per cent. of the stress in each post is transformed to a horizontal component at the top of the pier, therefore the feet of the posts are united, just above their pedestals, by a transverse member which will be bedded solid in the concrete body of the pier, will have 450 sq. in. cross sectional area, and will serve as a tie



Middle Section of Girder for Fixed Lateral Connections Pier 2.

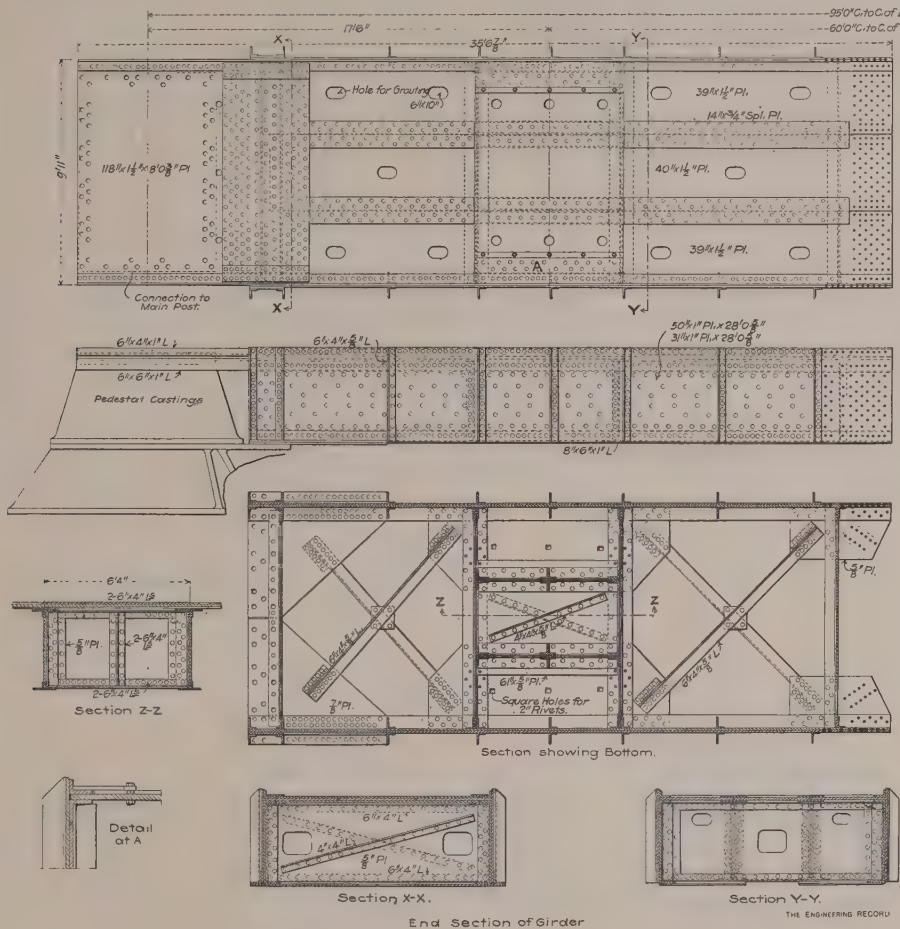
and as a girder to receive the bottom chords which are continuous from the island to the river spans. This member is a box girder about 10 ft. wide, 3½ ft. deep and 101 ft. long from out to out. It is made in three sections, with transverse and longitudinal diaphragms to stiffen it and distribute concentrated loads. It is in the same plane as the pier floorbeam, and a few inches clear of the lower flange of the latter. The floorbeam and girder are field-riveted together solid with the connections for the lower lateral diagonals, which intersect on the axis of the bridge at this point and their transverse components are carried through the girder to the pedestals. The girder is anchored at the center point by six 2-in. square rods 19 ft. long engaging reaction channels bedded in the concrete. Near the ends the girder supports the lower chords with pin connections in cast steel shoes, which were introduced chiefly for convenience in erection. As the chords here will be assembled before the girder is bedded in the concrete and will load it heavily, short steel pedestals are provided at these points for temporary support during erection, but will be left there and permanently built in the concrete.

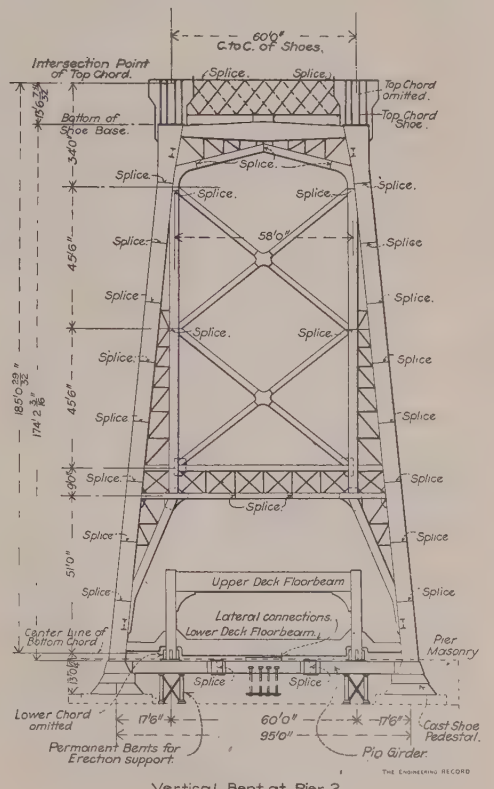
The end section of the girder has webs about 28 ft. long which at the outer ends rest on and are bolted to the projecting upper surface of the intermediate pedestal casting. At the other end

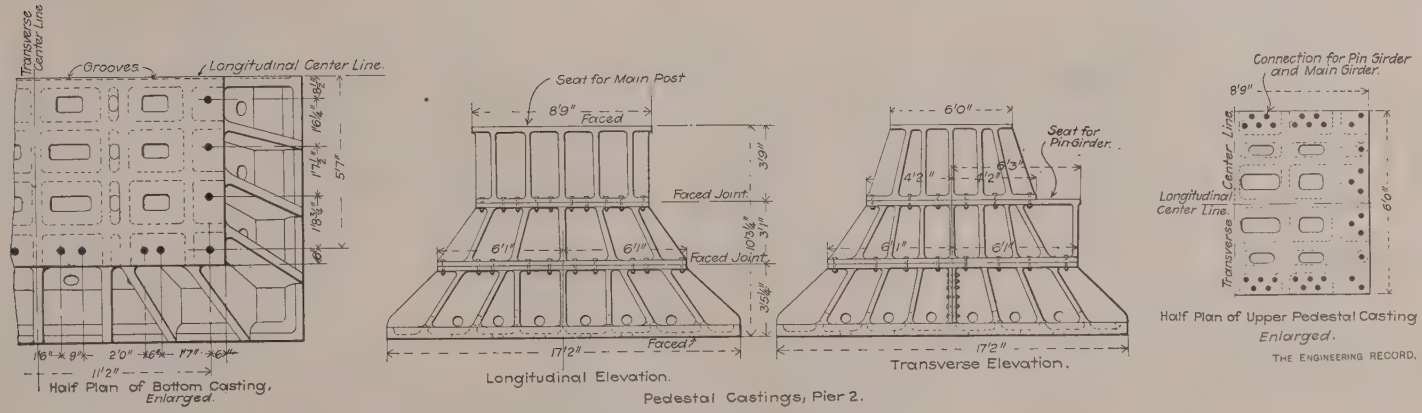
they are spliced with cover plates to the middle section of the girder. The webs are connected by vertical transverse diaphragm plates at both ends, and by an intermediate pair at the point where the chord shoe is seated on the top of the girder. Here the diaphragms are connected by a pair of longitudinal diaphragms with center stiffening angles, virtually forming a series of bearing girders to distribute the dead and live loads at panel points of the chords, which amounts to about 2,000,000 lb., and also to receive the top of the steel pedestal before mentioned, which is used in erection. All of the transverse diaphragms have two or three 12x15-in. manholes with rounded corners, and those at the ends are stiffened by X-brace angles riveted across the webs on one side. The web plates have single flange angles on the lower, and double flange angles on the upper edges, all turned inward. The lower flange angles are X-braced with lattice angles in the panels between diaphragms, and the upper flange angles engage a 1½-in. cover plate made in three longitudinal strips and spliced by pairs of 14x¾-in. cover plates. At the outer end of the girder this compound cover plate is cut a few inches shorter than the webs, and is spliced by top and bottom 1-in. cover plates of full transverse width, to a full width single plate which forms an extension of the cover plate, and projects 7½ ft. beyond the ends of the girder webs, together with the two pairs of top flange angles. This plate is planed on both sides, and has 64 2-in. holes drilled through it to the same template by which corresponding holes are drilled in the top of the pedestal casting, and in the base plate of the lower section of the main post, which is seated on it. This arrangement provides for the transmission of the horizontal component of the stress in the post into the girder and secures it to the pedestal.

The center section of the girder is 30 ft. long and corresponds to the end sections in general design, dimensions and materials. It is symmetrical about the center, and the webs are spliced with two plates on the outside and one plate on the inside. The top plates are spliced with a single cover plate, and the horizontal legs of the lower flange angles are spliced with pairs of flat bars. In the center of the girder four double pairs of vertical angles are riveted to the outside of each web to receive on their planed upper ends the bearing plates for the nuts of the 2-in. anchor rods.

The bottom lateral system is continuous across the pier from the island to the river span and the I-shape diagonals intersect on the center line of the pier girder and of the floorbeam at that point. Each one of them has a maximum stress of 955,000 lb., and is made with four 8x6x1½-in. flange angles, a 27x5½-in. web plate and two 24x12-in. flange cover plates. A short piece of each diagonal is cut out at the intersection so that their ends clear, and their top flanges are field-riveted to horizontal connection plates web connected to the floorbeam. Their bottom flanges are similarly riveted to a 106x⅝-in. horizontal connection plate 11 ft. 10 in. long, which receives all four pieces of the diagonals, but is about 16 in. clear above the top flange of the girder. Both longitudinal and transverse components of the stresses in the lateral system at this point must be transmitted through the girder and they are carried from the lower connection plate to the girder, where the latter is stiffened by longitudinal and transverse solid vertical diaphragms, and is designed







Pier Bent, Pedestal, and End of Girders for Pier 2.

to have a large bending moment both vertically and horizontally, though a rigid riveted pedestal or filler which is built up with heavy longitudinal and diagonal diaphragms riveted between the top plate of the girder and the connection plate on the bottom flanges of the lateral diagonals.

At pier 3 the vertical bent differs from that at pier 2 chiefly in providing for longitudinal expansion and contraction in the superstructure of the island and river spans. This relieves the pier girder from bending moments due to the stresses in the lower lateral diagonals, and it is proportioned for the horizontal component of the stresses in the main posts, and for the transverse component of the maximum lateral stress. These require a much less cross sectional area than the stresses at pier 2, and the girder is correspondingly modified. The web plates are a little narrower than those of pier 2 girder, and are not reinforced except at the diaphragms above the erection pedestals. They are moved closer together so that they are in the planes of the splice-plates for the top cover plate, and with the latter give the cross section the appearance of a T with a double stem. The top cover plate becomes more noticeably a complete plate girder with horizontal web which is supported on each side by eleven brackets in the planes of the transverse diaphragms, where it overhangs the vertical webs. The anchor rod connections are omitted in the center and the massive rigid connections for the lateral diagonals are replaced by a cast steel shoe, seated on the cover plate and shop riveted to it. The weight of pier 2 girder is about 150,000 lb., that of pier 3 girder is somewhat less.

(To be continued.)

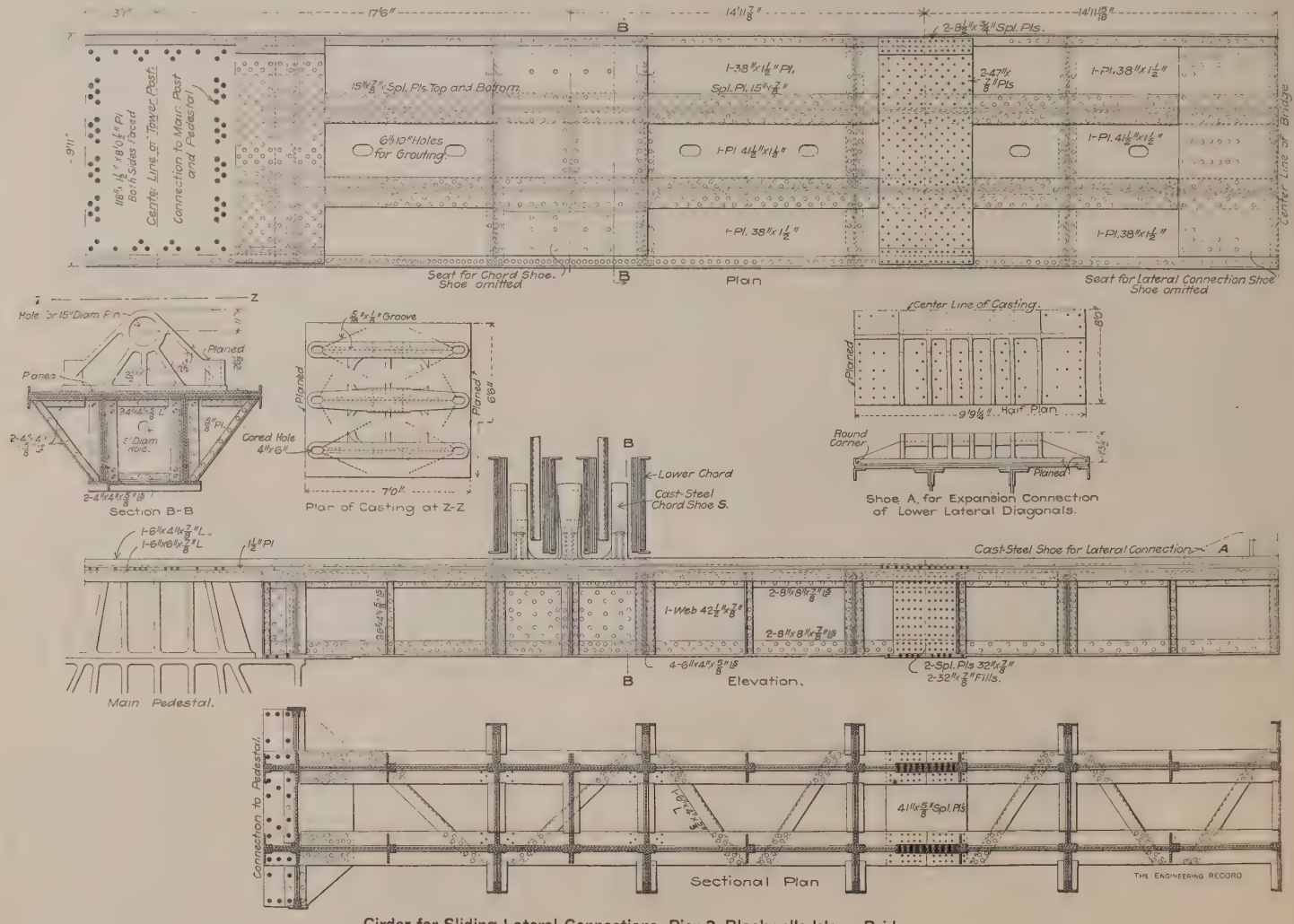
Improvements on the River Scheldt at Antwerp.

The plans which have been contemplated for a number of years for straightening and improving the River Scheldt in the vicinity of Antwerp will probably be executed in the immediate future, owing to the removal of political opposition to the project. The Scheldt at Antwerp is navigable by the largest ocean steamers, but a sharp bend in the river opposite the upper end of the city, where the shipping interests are largely located, renders navigation extremely dangerous during the flow and ebb of the tide. Beyond this turn the river makes a wide detour, at the end of which is a second sharp turn, in reverse direction to the first one, and a short distance farther on is a third reverse right-angle bend. The proposed improvements in the immediate vicinity of Antwerp comprise the cutting of an entirely new channel for the river, the formation of a harbor of the old river channel and the building of large shipping basins, with locks to keep the water in the basins at high tide level.

The new channel will be 4.7 miles long and will eliminate the three sharp turns and also two slighter ones between them. It will be on a slight curve, with its ends nearly tangent to the present channel, and will have a concrete quay wall, faced with masonry, along its eastern and outer side. The western bank will be an earthern fill, having a 5 to 1-paved slope face. The new channel at its upper end has a bottom width of about 1,635 ft., which is gradually increased to 2,150 ft. at the lower end to maintain uniform currents with the flow of the tide. The difference between high and low tide levels is about 14 ft. and the channel will have an average depth of about 33 ft. at low tide.

A westerly harbor will be formed by the construction of a dam at each end of the portion of the present river channel that will be cut off by the new channel. These dams will be arranged with locks by which the water in the old channel may be kept at high tide level if desired.

The scheme of the new channel and the plans for its excavation were proposed in a report made at the request of the Belgium Government by Mr. Lindon W. Bates, of New York, and the work will be carried on according to methods which have been developed by Mr. Bates in other dredging harbor improvement projects of similar character in this country, Europe and Australia. The

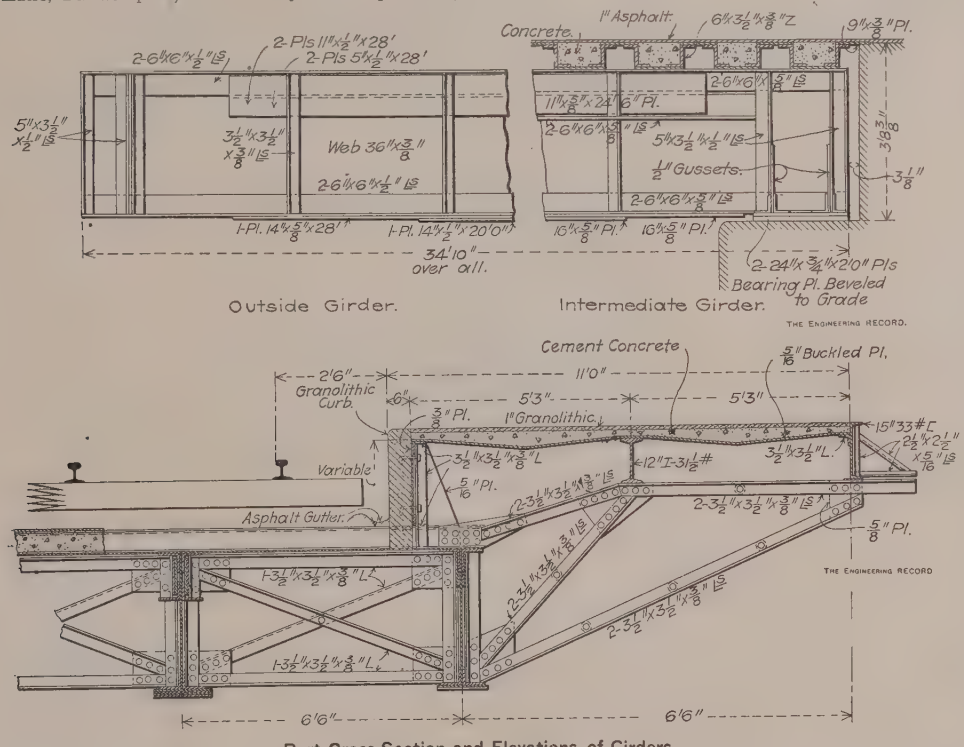


Girder for Sliding Lateral Connections, Pier 3, Blackwells Island Bridge.

The excavation of the new channel will require the moving of about 50,000,000 cu. yds. of material, and the works connected with it about as much more. A permanent 7,500-kw. electric generating station is to be built about midway on the edge of the new channel site and will supply power for the operation of the dredges. Other extensive improvements to the channel of the Scheldt below and above Antwerp are to be carried on by the Belgian Government, but the new channel will be executed according to Mr. Bates' plans, which were approved by the late Oberbaurth Franzius, consulting engineer of the Belgian Government. The auxiliary basins proposed by M. Royers, engineer of Antwerp, and M. Pierrot, state engineer of the River Scheldt, will be executed jointly by the general government and the municipality.

The Oak Lane Bridge, Reading Ry., Philadelphia.

A wooden trestle bridge carrying three tracks of the Philadelphia & Reading Railway over Oak Lane, Philadelphia, has recently been replaced by a two-span, deck plate girder structure, with a solid trough floor. The bridge is on a slight grade and crosses a 30-ft. roadway and a 10-ft. sidewalk, and in order to secure the greatest economy and least depth of girders, it was made with two spans, supported at the adjacent ends on a row of columns seated on the curb between the roadway and the sidewalk. The columns were made with pairs of channels latticed, and being only about 9 ft. high were not braced, except by brackets at the top connecting them to the end transverse struts between the girders. The bridge has nine girders, arranged to come under the center of each of four tracks one between each pair of tracks and one outside of each outside track. On one side of the bridge an 11-ft. sidewalk is carried on cantilever brackets, and on the other side provision is made for the same ultimate arrangement, but at present one of the four tracks is omitted there, and its position is temporarily occupied by the second sidewalk, which will be cantilevered out when the last track is laid.



Part Cross-Section and Elevations of Girders.

The girders over the roadway are made shallow on account of the limited headway, and are peculiar in that their top and bottom flanges are different. The outside girders have T-shape top and bottom flanges, but the top flanges are reinforced in the middle by 11-in. plates covering vertical legs of the angles, and projecting beyond their edges on filler plates. The intermediate girders have T-shape bottom flanges and H-shape top flanges made with two pairs of angles, both nearly full length, and cover plates reinforcing their vertical legs, except for a short distance at each end. Vertical web stiffener angles are fitted between the upper and lower angles of the top flange. At both ends the girders have double pairs of end web-stiffener angles to provide for the shear, and at the abutment end gusset plates are riveted to them to stiffen the 24x24-in. sole plates, which have expansion bearings on masonry plates beveled to grade, as are the column cap plates. The long span girders take bearing on nearly the whole surface of the column caps and their end vertical web-stiffener angles are field-riveted to those of the short-span girders about 12 ft. long, to support the latter, thus making the two spans continuous over the columns.

The girders are connected by four lines of transverse cross frames, and by the trough floor of transverse 6x3½x⅜-in. Z-bars, with 9x⅜-in. top plates and 12x⅜-in. bottom plates riveted across their top flanges. The permanent concrete sidewalk has a buckle plate floor platform retained between a curb girder riveted and knee-braced to the floor troughs and a fascia girder made with a 15-in. channel kneebraced to the cantilever brackets. The inner edge of the sidewalk is protected by a concrete curb 6 in. thick, and more than 2 ft. in its variable height, which is anchored to the web of the curb girder by hook bolts. The temporary granolithic sidewalk has a thin cement bed on the crowned surface of a cinder fill retained between a temporary fascia girder and a concrete curb anchored to by diagonal hook straps field-riveted to the webs of the Z-bar troughs which support the sidewalk and are intended later to carry the fourth track when sidewalk brackets have been added to the outside girder, and the sidewalk shall have been removed to them.

After the completion of the steelwork the floor troughs were filled with 1:3:6 concrete, the surface of which together with all the steelwork was painted with asphalt dissolved in naphtha. The deck was covered with 1 in. of mastic made with 60 parts, by weight, of Seyssel, Sicilian or Neufchatel rock, 10 parts refined Trinidad or Bermudez asphalt, and 30 parts of clean sand or grit passing a ¼-in. mesh sieve. This surface was covered with 1½ in. of sand, and ballasted for the track.

The bridge was designed in accordance with the standards and specifications of the Philadelphia & Reading R. R. Co., Mr. W. Hunter, chief engineer, and was built by the Lewis F. Shoemaker Co.

An Unusual Water Main.

Not long ago the Knickerbocker Construction Co. of New York laid about seven miles of "Universal" pipe in Little Falls, N. Y., under conditions seldom met. In the first place there was a franchise limit requiring the work to be done in a very short time. In the second place the soil was of a nature much more difficult to handle than had been expected, for underlying a stratum of clay in many places there were beds of quicksand. Men sank into this quicksand over the tops of their rubber boots. Short pieces of wood were placed across the ditch and the pipe laid in the ordinary way. In the smaller sizes of pipe many lengths were coupled together and lowered with ropes. In one section perhaps a mile long there was a clay soil which ran so badly that it was absolutely impossible to keep it dry. It was necessary to build a dam about every 300 ft., and pump the water out of this section, leaving in the bottom soft clay mud about a foot deep. This section was laid, another dam built, the first one broken down to let the water into the first, the second section was then pumped out, and in this way the pipe was laid without any very great difficulty.

The general manager of the company, Mr. L. B. Wheildon, states that in neither of these cases could the work have been done within the time limit had pipe with the ordinary lead joint been used. It is extremely doubtful if, on the second section referred to, the work could have been handled at all during the fall, as it was practically impossible to have taken care of the great amount of water that worked through the soil from both the river and the canal close by. It was necessary to cross at one place a very swift river in which it was impracticable for men to work. A dam and bridge were built to carry the river, but they proved impractical, and it was necessary to level the bottom, put the pipe together and lower it in. It was also necessary to cross two canal bridges bringing all sorts of angles, and the bridges were so light that every time a loaded wagon crossed them they vibrated very much. The pipes have never been touched since they have been there and have been perfectly tight, Mr. Wheildon states, even where laid under the most adverse conditions.

Another case that would have been extremely difficult with lead joint pipe was work under a double concrete culvert. A tunnel was driven under the width of this culvert, the pipe coupled together and a chain run through it. A chain fall was put on, and the pipe slid through and coupled to the two ends, the tunnel filled in and that ended the matter. The pipe used was from 10 to 4 in. All along the entire line hydrants were set every 300 ft. In order to get the work completed within the limited time, the construction of the plant was begun at the wrong end, working back to the water supply. The pipe was full of air and it was very difficult to get it all out. The pressure was 120 lb. and at the start there was a tremendous water hammer. No serious trouble came with this, however. The pipe was furnished by the Central Foundry Co., of New York.

Conclusions Reached at the International Railway Congress.

The International Railway Congress, at its various conventions, usually adopts "conclusions" concerning various subjects discussed by the various sections. Those conclusions adopted last week which are particularly interesting to the readers of this journal are the following:

Cross Ties.—The pickling of sleepers in order to lengthen their lives is to be generally recommended; the selection of the antiseptic and the method of performing the pickling operations depend on individual conditions.

Creosote seems to be the best preservative of sleepers; it has been successfully tried for a longer time than any other antiseptic and the results have proved that a creosoted cross tie will last in main line service many times as long as an untreated cross tie.

Either hard or soft woods may be used, the selection depending on local conditions.

Specifications must be exact and great care should be exercised by the inspector before accepting cross ties for treatment. When accepted the sleepers should be piled at least 6 in. above the ground in open stacks in such a manner as to allow free access of air and light. The grounds surrounding the piles of sleepers should be kept clean and free from decaying matter.

The uncovering of the ties by removing the ballast from the top surface does not appear to diminish the life of the wood even for untreated timber, and it has the advantage of enabling the track inspector to discover at once any defects in the track fastenings, etc., and to apply a remedy. To some special cases, and especially in warmer countries, it may be useful to cover the timber with ballast.

It is of importance to combine rigid inspection in accepting sleepers with great care in the selection of ballast; the latter must be permeable, must be capable of being well packed and the packing well maintained, and give good adhesion between the sleeper and its seat. As far as this is concerned the measures which are best for the preservation of the wood are also best for the stiffness of the track.

In order to prevent deterioration of the ballast and at the same time help to preserve the sleepers, the careful drainage of the roadbed cannot be too carefully insisted upon in order to insure that water may run off properly.

To prevent mechanical wear and tear of the rails upon the sleepers, it is of the greatest importance to fasten the rail to the cross tie in such a manner as to prevent as much as possible all vertical, lateral and horizontal movement between the two. The old American method of using only spikes will not accomplish this. Lag screws seem to be necessary to attain satisfactory results.

It is only by keeping careful and accurate records of the number of ties treated, the manner in which they were treated, and where and when they were placed in the track, together with a record of when they were taken out of the track, that it is possible to determine whether any one particular treatment is giving satisfaction and is a good investment. Every railroad management using treated ties is urged to have them all marked, preferably with dating nails, and that a careful system of records should be instituted at the earliest possible time.

Frogs.—On all main lines carrying heavy traffic with axle loadings on the locomotive of over 50,000 lb., and with loads on the rolling stock reaching as high as 40,080 lb. per axle, the "spring rail frog" or the "hinged spring frog" may be used with perfect safety, where the traffic on the side tracks connecting with the main track is very slight compared with the main traffic.

The "movable point frogs" may be used at all termini where the space for crossing from one track to another is limited, but that where space permits, and where high speed is necessary, a series of switches with the best designed switches and fixed frogs are preferable.

Lighting and Heating.—As regards lighting, the congress notes the development of the use of incandescent mantles, heated by oil gas and sometimes by common gas, and of different systems of electric lighting. Cylindrical mantles seem to be somewhat stronger than globe mantles, but the latter distribute the light somewhat better. Various types of mantles are used in Europe by different managements, especialy in France and Germany, and are beginning to extend to the United States.

Systems of electric lighting are giving satisfaction on different roads. Attention is called to their advantage in certain cases for intermittent lighting, in passing through tunnels and operating driving fans.

Acetylene gas has been used mixed with Pintsch gas, especially in France and Germany, but a tendency is observed to abandon this mixture, owing to the use of mantles. On the other hand, mention is made of the use in America of pure compressed acetylene, with some special precautions.

Steam heating has a tendency to extend in different countries. To obtain sufficient heat for very long trains, or in cases of very low temperature, care is taken either to use pipes of sufficient diameter or compressed air mixed with steam.

The congress notes the different systems of car ventilation that have been applied, especially that in use on the Pennsylvania Railroad.

Automatic Block Signals.—Automatic signaling properly designed and installed is recognized as a suitable means of protecting train and switching movements.

The congress notes that there has been much improvement and extension of the automatic signalling since the last congress, and that those who have used it have found it effective for their purpose.

The congress is not prepared to recommend automatic block signalling for general adoption to supersede existing systems, but they consider there are cases where this system may present special advantages.

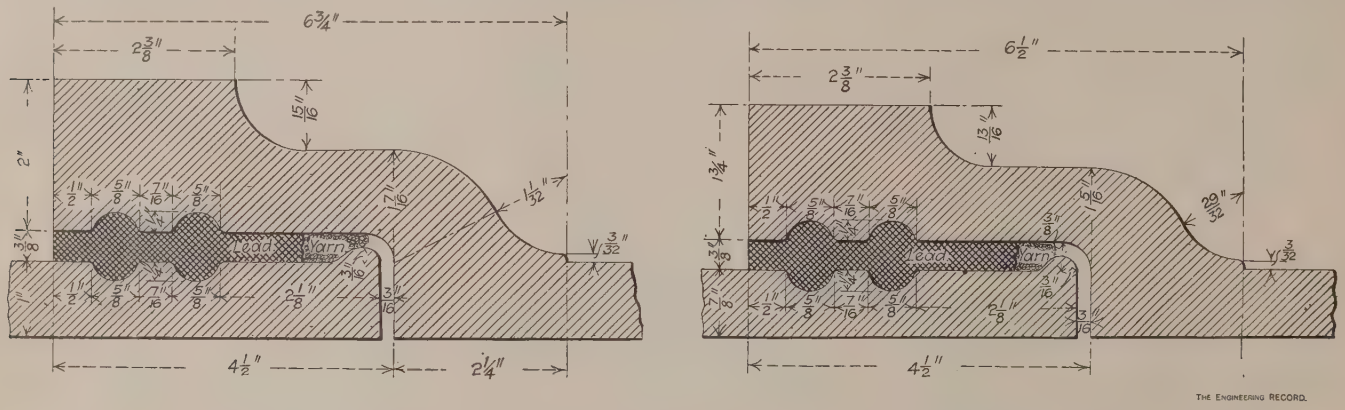
Reinforced Concrete.—Reinforced concrete has received many and important applications on railroads, both from the technical and economical points of view; it can fully and successfully compete with masonry and timber or steel construction.

Tests of reinforced concrete structures, theoretical researches on the question, and the results of practice justify the conclusion that such structures need not cause any apprehension, and that their further extension is strongly recommended to railway administrations.

Railroad practice shows that carefully built reinforced concrete structures give excellent service and require almost no maintenance. For this reason the use of reinforced concrete should be recommended, even if the cost of construction should occasionally be higher than for another system of construction.

Reinforced concrete structures are an especially great help in countries where stone or iron are difficult to obtain in large sizes.

Reinforced concrete permits the rapid building of structures with readily obtained materials and this avoids the necessity, so trying in practice, of giving special orders to shops.

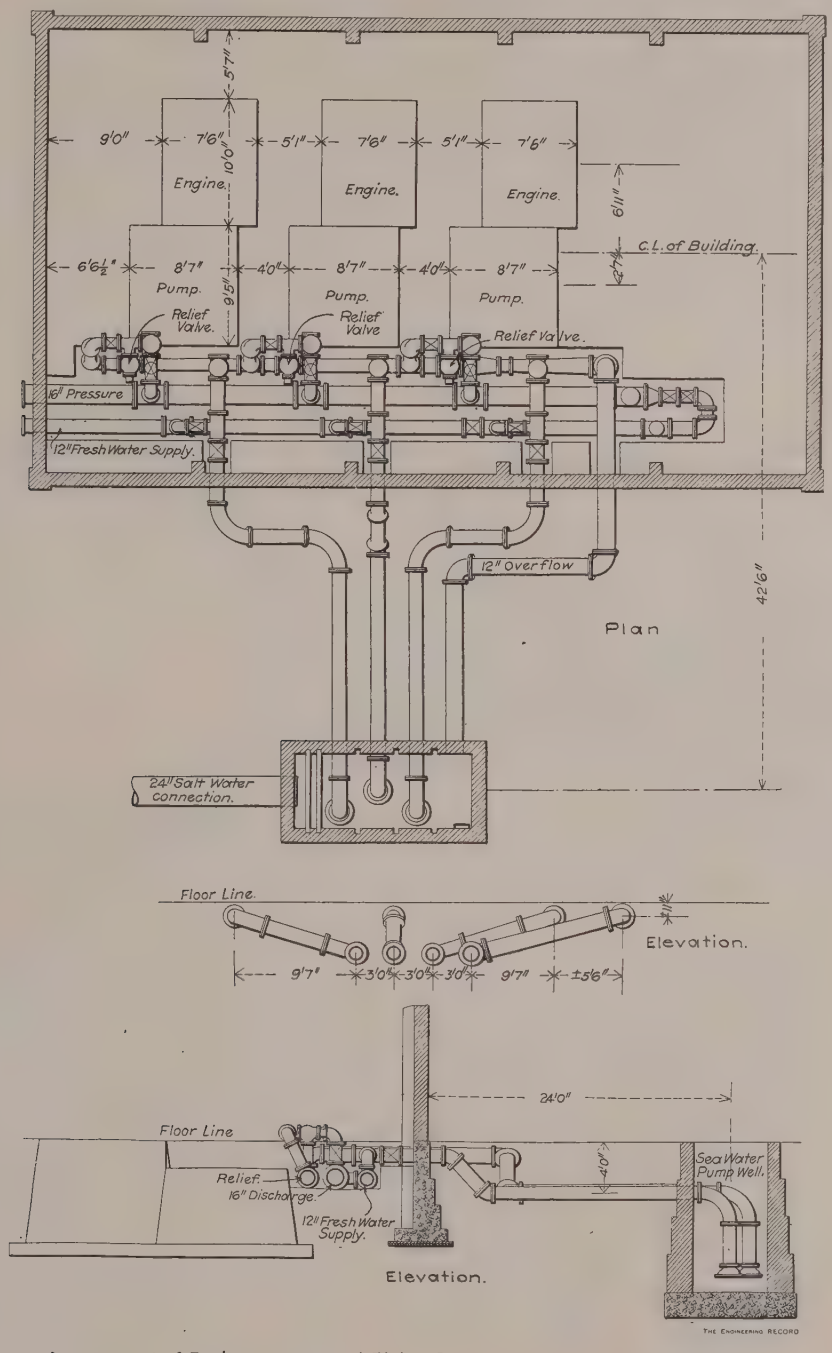


Details of the Double-Groove Lead Joints on the Cast-Iron Mains of the Coney Island High-Pressure System.

The Adoption of the Low-Pressure Gas Buoy by the Canadian Government is in part the result of a recent explosion of some of the high-pressure buoys when being filled. The explosion occurred just after the buoy had been filled with gas to 180 lb., the rupture taking place along a 4-ft. welded seam, which, it is thought, was not properly welded originally; considerable damage resulted from flying pieces penetrating an adjoining buoy, which caused it to explode also. The new low-pressure buoys are of the acetylene gas type which carry the charge of calcium carbide upon a grating in a central tube, and are so piped that when in service water enters from the bottom to the carbide for the generation of the acetylene gas; the gas, which forms rapidly, produces pressure at once sufficient to expel further supply of water until the supply formed is partially exhausted, when the reduced pressure permits more water to enter and create more gas. The carbide is carried upon a grating so that when it is expended in the formation of gas it drops through in the form of fine powder. The operation is automatic and very successful, and as the pressure does not exceed about 3 or 4 lb. per square inch, it is perfectly safe.

A High-Pressure Water System at Coney Island, N. Y.

A high-pressure waterworks system is being constructed which will furnish fire protection to the seashore summer resort on Coney Island, New York City. The system has been designed to supply 3,600 to 4,500 gal. per minute under a pressure of 150 lb. per square inch at the pumps, which will produce a pressure of at least 125 lb. at the fire hydrants, when the full capacity of the station is utilized. The pumping plant consists of three vertical, triplex, double-acting pumps direct-connected to vertical, three-cylinder, single-acting, four-cycle type gas engines. Each unit has a capacity of from 1,200 gal. to 1,500 gal. per minute and the pumping station is located and designed so that it may supply either fresh or salt water through a system of mains and hydrants that is entirely independent of the regular distribution system.



Arrangement of Engines, Pumps and Piping Connections in the Station Building.

The conditions which require the protection afforded by the new system are unusual and perhaps peculiar to the district that is benefitted by it. The island on which the resort is located is a long, low bar of sand on the southwestern shore of Long Island, about 10 miles from the business center of the Borough of Brooklyn, and is separated from the mainland, which is also low and swampy in the vicinity, by a narrow arm of the ocean. The principal buildings of the resort contain large places of public amusement and are built very closely together. They face on both sides of a wide avenue closely paralleling the beach for about three-quarters of a mile and on private walks leading from one side of this avenue for some distance out over the water. Practically all of the buildings are one or two-story timber structures on pile foundations or have timber frames with ornamental staff covering, and their contents in many cases are quite valuable, though often highly combustible. The congested manner in which the district is built up centers large investments in a small area and the fire protection is now afforded by one truck and two fire engines which draw their supply from the regular distribution system. This system was, until recently, supplied by a 12-in. pipe line from a pumping station about 2 miles distant and scarcely furnished sufficient water for the regular domestic demand. The apparatus on the island is unable to cope with anything more than an ordinary blaze, under the conditions, and within 40 minutes no more than 6 steamers could be brought into service. The fire risk is consequently great and several large fires have occurred in recent years which have more or less completely wiped out the district.

The building of an isolated, high-pressure pumping station supplying water through independent mains was the most feasible method of providing fire protection under the existing circumstances. A steam plant would have been unavailable, and the nearest electric generating station is 6 miles distant, while a gas holder is located within 2,000 ft. of the station site. Although the first cost of a gas-engine equipment was greater than the estimated cost of an electric motor equipment, under the existing conditions the nearness of the gas holder was considered to outweigh the advantages of a plant electrically driven.

The 37x62-ft., one-story brick station building is 1,500 ft. from the main avenue of the protected area and about opposite the center of that area, on the bank of a narrow inlet, called Coney Island Creek, which separates Coney Island from the mainland. It is built on a heavy concrete base laid on a pile foundation. Its site is on soft ground about 3 ft. above mean high tide, and great difficulty was experienced in obtaining firm beds for the engines and pumps.

The pumps will be furnished with fresh water by two practically separate supply lines. The 12-in. main which alone originally furnished water to the distribution system on the island, passes within 300 ft. of the station and is connected to the suctions of the pumps by a 12-in. main. A 20-in. main, laid recently from a storage reservoir in the city to the island to supply the increased demands on the distribution system, passes close to the station and is also connected to the main leading to the pumps, so with the exception of about 300 ft. of pipe, the station has two separate freshwater supply lines. The connections with the gas holder are somewhat similarly arranged, providing two separate gas main supply lines, although they are both connected to the same holder.

The mains of the high-pressure system will be kept filled with fresh water under distribution pressure and the pumps will ordinarily supply fresh water, but a connection is made with Coney Island Creek, adjacent to the station, in order that salt water may be used in an emergency. A 6x14½-ft. pump well, 12 ft. deep, is built just back of the station building and is connected by a 24-in. intake main with a brick manhole which has an intake 9 ft. below mean high tide in the creek.

The general arrangement of the engines, pumps and piping in the station building is shown in an accompanying illustration. The 12-in. fresh-water supply main enters at one side and extends the length of the building under the separate suction connection of each pump with the salt-water pump well, each of these suction connections being connected to it. It is directly connected to each pump and each pump is also connected with a 14-in. overflow leading to the salt-water pump well.

The gas engines are of the Nash type, built by the National Meter Co., and are specially adapted to use illuminating gas, being required to consume per brake horsepower per hour not more than 20 cu. ft. of gas having no more than 670 nor less than 630 B.t.u. per cubic foot. Each engine is equipped with a speed regulator so arranged that if the load is suddenly thrown

off when the engine is running at full load the speed variation will not exceed 3 per cent. The valves of one cylinder on each engine are so arranged that the cylinder may be operated by compressed air on starting without disturbing the mechanism of the other two cylinders. The compressed air is supplied by one or both of two separate compressors with individual pressure tanks, one compressor being driven by a small gas engine and the other by a belt on the shaft of one of the larger engines. The igniters are supplied from primary batteries and also from a motor-driven dynamo. The engines developed 175 b.h.p. in a shop test and have complied with the speed regulation and gas consumption requirements.

The pumps are specially designed to resist the corrosive effects of salt water and were built by the Goulds Mfg. Co. The parts exposed to the water are either made of composition metal or are covered with it, while the plunger rods are of Tobin bronze. The fuel supply and all of the machinery equipment has been designed to be at least in duplicate and provision is made for the installation of a fourth pumping unit. The pumps and engines are to be subjected to a 24-hr. endurance and capacity test after their installation.

The engines are required to attain full speed and produce the maximum pressure at the pumps in one minute, the method of starting being as follows: Each engine is started with the valve on the by-pass connection of its pump open and when it has attained full speed this valve is gradually closed by an electric motor, which stops automatically when the valve is fully opened or closed; the pump then begins to deliver water to the mains. A relief valve on the discharge of each pump may be set at any desired pressure up to 200 lb. When the pressure in the main exceeds that at which the valves are set, the valve opens and the pumps discharge through suitable connections into the overflow.

A 16-in. pressure main leads from the pumps to the avenue along which the protected area lies, and extends in both directions along this avenue too the limits of the district. Several 12-in. branches from it are laid under the walks leading out over the beach and a number of private connections, for fire protection only, have also been made. The heavy cast-iron pipe used in the mains has special double-grooved lead joints, which are shown in an accompanying illustration. These joints are similar to those of the high-pressure system which has just been started for the protection of the business district of the Borough of Brooklyn and of those on the mains in the proposed high-pressure system in the lower part of the Borough of Manhattan. The pipe was made extra heavy to provide for the corrosive action of salt water, as well as for the high pressure and was cast by the Warren Foundry & Machine Co. The system is to be tested after it is in operation and the mains are required to show a leakage of not more than 4 gal. per linear foot of joint per 24 hr. under a pressure of 225 lb., the leakage to be measured by meters.

The hydrants are 3 and 4 way, with 2½-in. hose connections. They are placed so that the full capacity of the system, fourteen to eighteen 250-gal. fire streams, can be concentrated on any one block of buildings in the protected district. They were furnished by the Rensselaer Mfg. Co., and the 8-in. branches on which they are placed have flange-joint connections with the mains and with the hydrants.

The mains were laid almost entirely through fine beach sand and the bottom of the trench in most places was below high tide. This condition required close sheeting of much of the trench and continual pumping in many places. The irregular manner in which the sub-surface structures on the island have been developed, required their relocation in many places before the mains could be laid.

The mains have been laid, the station building is being rapidly constructed and the system will be ready for operation early in the coming summer. Plans for the installation of the system were prepared and contracts awarded under Mr. I. M. de Varona, chief engineer of the Department of Water Supply, Gas and Electricity. The work of construction is under the immediate supervision of Assistant Engineer J. Goodman, who, with Mr. W. W. Brush, also assisted in the preparation of the plans.

The Completed Fraser River Bridge.

An important bridge involving some unusual features of design and methods of construction has recently been completed under exceptional conditions at New Westminster, British Columbia, where railroad tracks, street cars and highway traffic are carried across the Fraser River on a steel superstructure about 2,400 ft. long, which includes five 162-ft., two 384-ft. and one 232-ft. truss spans and viaduct approaches. It is double-decked to accommodate highway traffic on the upper and railroad traffic on the lower floors. The steelwork is mostly conformable to ordinary features of design except in one span, which is most prominently shown in the accompanying illustration.

Triangular Span of Fraser River Bridge.

This span is of an extraordinary design, which was considered to be demanded by the difficulties of the situation and the requirements of the traffic and was developed in a manner that has probably no close parallel. At this point the approaches are on three divergent lines intersecting at a considerable distance from shore, where the depth of the water, the character of the bottom and the velocity of the current made the construction of ordinary substructure difficult and costly. In order to minimize it a triangular span was constructed which has two convergent pin-connected trusses 232 ft. long, seated at the river end on an ordinary pier 154 ft. high above the bottom of its footing and seated at the opposite end on two independent piers about 140 ft. apart.

The trusses are stiffened laterally by horizontal auxiliary trusses and by diagonal struts, both in the planes of the top chords. The lower chords are connected by floorbeams of unusual magnitude, which carry directly the curved divergent railroad tracks to their separate plate-girder viaducts and which also support a substantially independent viaduct on the center line for the upper deck highway. The construction and arrangement is so effectively shown in the accompanying illustration that it is presented here in addition to the technical description which was published in The Engineering Record of April 30, May 7, 14, 21 and 28, 1904.

The triangular span weighs about 800 tons and the longest floorbeam, which appears in the foreground of the picture, is a box plate-girder about 134 ft. long, 12½ ft. deep and 4 ft. wide, which weighs nearly 180,000 lb. and was assembled like a complete bridge on pile falsework constructed in the river after the trusses were in position. The method of erecting the trusses themselves was a very unusual one and consisted of assembling one of them separately on shallow-water falsework alongside a completed span at the other end of the bridge, then moving it on barges a considerable distance through a horizontal arc and assembling the other truss in its former position. The two were then braced together, loaded on three special barges and floated to their permanent positions on the piers, the long floor beam built up between them and three more smaller floorbeams weighing from 31 to 77 tons each assembled on the same falsework and floated to their successive positions in the spans, as if they had been independent bridges. The erection methods and plant were of a very interesting character and were fully illustrated in The Engineering Record of August 13, 1904.

The total weight of the bridge is about 8,000,000 lb. and it was opened with considerable ceremony July 23, 1904. Waddell & Hedrick were the engineers, and the Dominion Bridge Co. and Armstrong, Morris & Balfour were the contractors for the superstructure and substructure respectively.

The Mining of Sulphur from beneath a bed of quicksand is being successfully carried out in Louisiana by passing steam down to the deposit through 4-in. tubes and locating similar tubes nearby from which the molten sulphur may be taken out. The steam easily melts the sulphur, which is found 98 per cent. pure, and its pressure forces it out in the molten state. It is then cooled and broken up for shipment.

Letters to the Editor.

The Laredo Tornado.

Sir:—Thinking you might be interested in our tornado of the night of April 28, I send you a few views of the International Bridge which had two spans blown away, or rather off of the pillars it rests upon, down into the river below. The bridge spans the Rio Grande River at this place, connecting what they call the two Laredos, Laredo, Mexico, and Laredo, Texas; the total length of the bridge is 810 ft. It was built in 1888, and consists of five spans of 150 ft. each, and one approach on the Texas side of 60 ft. The damage done is estimated by the superintendent here at about $20,000, although personally I don't think it is that much. Friday evening, April 27, at about 7 o'clock, after a sultry day, the storm broke over us. For several hours the horizon in the west had been looking bad, but nothing to indicate what was to come; it came with such suddenness that no time was given for preparation.

Bridge over the Rio Grande River Wrecked by Tornado.

In the view "Wreck of the Bridge" the photograph was taken from the Mexican side, a little back of the wreck of the custom or inspectors' house, and it does not show the river plain between the portion of the bridge left standing and the Mexican side. At the end of the bridge on the American side, you see to the left the standpipe of the Laredo Water Works, and one chimney; they had two chimneys, but one was blown down. (For description of water tower see Goodell's "Water Works for Small Cities and Towns.") To the right of bridge the tall building is the convent belonging to the Ursuline Sisters, which is at the north end of the bridge (the bridge runs north and south); the west side of the convent had all its window panes blown out, and a small frame house at the back was blown completely over. My home is at the next corner of the convent in the same block and is a two-story house. It was much more exposed to the storm, but I suffered hardly any damage, while within 10 ft. of my dining-room door a tree almost 2 ft. thick was blown down, and about 30 ft. to the southeast of my dining-room a big telegraph pole carrying a heavy cable, which carries the telephone wires across the river, was blown down and broken into three pieces.

Wreck of Bridge as Seen from the Mexican Side.

View of Wrecked Bridge Showing Cracks in Concrete Base.

It seems the storm came down the river mostly on the Mexican side and hit the two spans of the bridge close to that side and completely lifted them off their moorings, leaving the rest clear and in good condition with the exception of the beam which carries the foot walk which was pulled loose. Outside of that the rest of the bridge seems to be unharmed. At each end of the bridge are a few small frame houses, used by the immigrant and customs inspectors, and for a toll office, as this is a toll bridge. The toll office on the American side was unroofed and the roof blown over on the inspectors' office; on the Mexican side, both houses were completely wrecked; one was blown entirely to pieces, the other blown over.

The view of "The Bridge Over the Rio Grande," which was taken from a boat in the river, gives you an idea of how the wreck looks. In the second view, the photograph was taken from the end of the remaining portion of the bridge looking towards the Mexican side. The bridge was carried on steel cylinders about 4 or 5 ft. in diameter, filled with concrete, and they in turn imbedded in good concrete foundations. Cracks occurred in the concrete foundation some time ago and were lately repaired, but it seems that the strain was so great on the downstream or east side as to crack it again, but the crack does not amount to much.

Besides the damage to the bridge the cities on both sides suffered considerably. The roofs of fully one-quarter of the houses were blown off, several buildings wrecked and twenty-one persons killed. The shops of the National Railroad of Mexico, about one mile farther down the river, were completely destroyed and loaded cars were blown off of the track or turned over. The bridge is owned by a New York syndicate, and I understand will be immediately repaired; it is used as a foot and wagon bridge, and was considered very strong. Water in the river has been so high that you could touch it from the bridge with your hand, and the bridge never suffered. A railway bridge about 200 or 300 yds. farther upstream was uninjured.

Yours truly, M. S. Ryan.

Laredo, Texas, May 3.

Civil Engineer's Library.

Sir:—Upon being requested to furnish to a member of the profession a list of books which would form a good civil engineer's library, I undertook to recommend the following: The young man had $100 to invest in such a library and desired to purchase the very best one he could for the money. This list of books would cost over $100, but in all probability after a discount had been secured the same could be bought for an outlay of only about $85. Perhaps you may find the opportunity to publish this letter in your columns for the benefit of some ambitious young engineer. The following is the list of books: The Theory and Practice of Surveying, Johnson, $4; Mechanics of Engineering, I. P. Church, $5; Materials of Construction, Johnson, $6; Cement and Concrete, Sabin, $5; Treatise on Concrete, Plain and Reinforced, Taylor and Thompson, $5; Treatise on Foundations, Patton, $5; Civil Engineer's Pocket-Book, Trautwine, $5; Architects and Builders' Pocket-Book, Kidder, $5; Highway Construction, Byrne, $5; A Text-Book on Roofs and Bridges, 4 vols., Merriman and Jacoby, $10; A Treatise on Arches, Howe, $4;

A Treatise on Hydraulics, Merriman, $5; Public Water Supplies, Turneaure and Russell, $5; Filtration of Public Water Supplies, Allen Hazen, $3; Water Works for Small Cities and Towns, Goodell, $2; Design and Construction of Dams, Wegmann, $5; Sewerage, Folwell, $3; Sewer Design, H. N. Ogden, $2; Searles' Field Engineering, 03; Crandall's Earthwork Tables, $1.50; Allen's Railway Curves, $3; Electric Railway Economics; $2; one year's subscription to The Engineering Record, $3; one year's subscription to Engineering News, $5; total, $101.50.

Yours truly, G. W. Ellis, C. E.
Buffalo, N. Y., May 4.

Wharves as Septic Tanks.

Sir:—I have read with much interest your editorial "The Pollution of New York Harbor," in the Record of May 6, and also the article "Sewage Discharge into New York Bay." Taking your estimate of the dry weather flow of sewage daily into New York Harbor from the present population as 505,000,000 gal., and your estimated area of the Harbor and the Hudson River at 78.4 sq. miles, as correct, it is a matter of computation to demonstrate that in one year such an amount of sewage would cover such an area to the depth of over 11 ft. If the sewage were concentrated upon half of that area, as it is, as a matter of fact, it would cover the area to a depth of over 22 ft.

The experiments carried on at Lawrence by the State of Massachusetts since 1887 to the present time have demonstrated that sewage carries in suspension one part of solid organic matter in every thousand parts of water; that the solid part of organic matter unites with nine times its bulk of water and forms "sludge"; and that the sludge precipitated from sewage varies from 1 to 3 per cent. of the bulk of the sewage. It is a matter of common knowledge that the elements in salt water precipitate the solid organic matter carried in suspension in the sewage and arrest decomposition.

Allowing the average depth of the Harbor and adjacent waters to be 20 ft., and that the population of the city does not increase, the life of the harbor under present conditions may be as short as 200 years. It is only a question of time before the most convenient and capacious harbor in the world is ruined. The only benefit derived from discharging the sewage of the city into the Harbor at present is its effect in preserving the wooden piles of the piers from destruction.

Now that better piles of concrete and metal can replace the piles of wood, there is no good reason for letting the sewage injure the Harbor. The sewage at one time was permitted to enter the docks at the most convenient point, but dredging was found very expensive as well as offensive; so the sewage was diverted from the docks and carried by wooden conduits to the ends of the piers and there discharged into the Harbor.

There is a space in New York City at the present time of no use to any one in which the sewage of the city may be purified to such an extent that it will not injure the Harbor, the marine life in the Harbor, or people living on or near the Harbor; it is the space between high and low water in the piers. In a pier 600 ft. long and 60 ft. wide, this space, 5 ft. deep, would hold 180,000 cu. ft. or 1,350,000 gal. If a tank filled such a space and received daily 1,350,000 gal. of sewage, in the course of two years it would eliminate 900,000 cu. ft. of sludge and prevent it from settling in the Harbor. It could do better; it could receive 13,500,000 gal. of sewage, and arrest 5,400,000 cu. ft. of sludge yearly, or 200,000 cu. yd. (according to Professor Talbot's experiments reported in your journal a number of years ago).

Allowing that it would cost 25 cents per yard to remove the sludge by dredging from the harbor, such a tank would save the city or the United States $50,000 per year, which is the interest on $1,000,000 at 5 per cent. When a new pier is built by the city in the future such a tank could be built without much additional expense—and extra floor and side walls—instead of the outfall sewer or conduit of wood. I proposed the above scheme to the authorities of New York in the winter of 1899—under the Glover patents—but was told to wait until the city wanted the work done.

Yours truly, John N. McClintock.
Boston, May 8.

The Harvard-M. I. T. Alliance.

Sir:—There is such widespread misunderstanding of the attitude of the faculty and former students of the Massachusetts Institute of Technology towards the proposed alliance with Harvard, that the public should be definitely informed, in as few words as possible, of the real grounds of the opposition of at least 90 per cent. of the men of those two bodies. College loyalty and sentiment, very properly, play a part in determining their attitude towards the suggested partnership, but it is a very minor one; the chief grounds of opposition are to be found in that commonsense, clear-thinking and business caution which the Institute training does so much to foster. The theoretical advantages of such an alliance are indeed attractive; but when reduced to the practical details of a definite plan, based upon the actual conditions to be met, the objects desired can be but partially realized, if at all, and serious complications arise which make the experiment dangerous and unwarranted.

Four main arguments are used in urging Institute men to ratify this proposed alliance: (1) That it will bring in money, (2) that it will save money, (3) that it will broaden the Institute education, and (4) that it will promote the cause of higher education. Even were all these advantages to be secured, theoretically, through an alliance with Harvard, the faculty and former students of the Institute object, by an overwhelming majority, to the practical means proposed. By this "Proposed Agreement" Technology is called upon to sign a contract vague and unbusinesslike in form, revocable at the will of either party, wholly contingent upon legal interpretations and decisions, pregnant with misunderstandings and requiring the Institute to assume most of the present burdens and, in case of rupture, all future losses. The plea that this is a "gentlemen's agreement" does not reassure men accustomed, as are those of the Institute, to reading contracts and weighing their probable results. Long experience has taught them that such documents must sooner or later face the courts and that the law reads them as they are written, not as "gentlemen" may be willing to interpret them.

This "agreement," moreover, requires the Institute to bury all her present resources in real estate near enough to Cambridge to share the disadvantages of that locality, but not near enough to partake of the real advantages of the collegiate environment; forces her to agree to reimburse the University in the event of annulment of the contract, and compels her to reorganize her government, to limit her choice of an executive board and radically to change a policy which has given her the prestige she now holds—a prestige which has been attained, moreover, only because of her unique position as an independent institution.

Setting aside the question of the moral right of the University, even though she may secure legal permission, to divert bequests from their intended purposes, and assuming that the Supreme Court decides that a part of the McKay money may legally be spent at the Institute, even then this highly objectionable "agreement" does not achieve what it is supposed to accomplish. Were it to be ratified, the Institute, for a generation to come, would secure from Harvard only money enough to pay the cost of teaching the Lawrence Scientific School students and would be compelled to bear the whole burden of providing for the natural expansion of the combined institution. The McKay Endowment, under this plan of alliance, would yield to the Institute only three-fifths of the income of the net income of the estate for about fifty years, and the sum then available would be only three-fifths of the income of the accumulation of about five million dollars. To offset this, however, the Institute would lose at least two million dollars in bequests contingent upon her independence, would undoubtedly forfeit State support, and, most serious of all, would almost wholly cut off the present and future support (direct and indirect) of the more than six thousand former students who are now enthusiastically ready to assist her.

The plan of alliance will not save money for the Institute, because it does not and—except by giving a cheaper and less thorough education—can not avoid duplication in either instruction or equipment. To save money in administration (following the example of business "mergers") is possible, but only on condition of making the Institute an integral part of Harvard University.

The plan will not really broaden the educational life of the Institute; it will merely substitute for the well recognized and thoroughly tested spirit of Technology the different spirit of the University. The students of the Institute, already pressed with the necessary work of their own courses, could find no time for intercourse with those of Harvard, even were they to be admitted (as Dr. Pritchett says they are not) to the undergraduate classes of the University. The association of Harvard and Institute professors upon one faculty is likely to lead to friction rather than to educational development, since the Harvard members to be injected are mainly heads of established courses. As to the broadening which is supposed to come from paying larger salaries to teachers, that cannot take place for at least fifty years, since neither the "Proposed Agreement," nor the McKay Endowment (until the death of the last annuitant) can provide higher salaries.

The projected alliance, finally, will injure, not help, the cause of higher education: (1) Because it does away with competition, that leading stimulus to educational development, (2) because it creates a school too large for the only right kind of higher education—that which places every student under the immediate supervision of one or more members of the faculty, (3) because it restricts the choice of youth seeking a higher technological education to one kind of institution in this educational centre, and (4) because it brings to an end the great endeavor of Rogers, Runkle, Walker and their associates to build up, on a basis of science, modern languages, history and economics, a true university which shall meet modern conditions and needs more fully than can any of the older colleges.

Yours truly, M. I. T. Alumnus.
Boston, May 13, 1905.

Water Softening Plants for power stations of 1,000 h.p. or less cost from $4 to $5 per horse power, where steel tanks are used. This figure is materially reduced for larger installations. Where reasonable care is taken, the tanks do not depreciate more than 5 per cent. annually. These figures are given in the "American Electrician" by Mr. G. E. Walsh, who adds that wood tanks depreciate so rapidly that they are undesirable unless very inexpensive.

CURRENT NEWS SUPPLEMENT

MAY 20, 1905.

DIRECTORY OF NATIONAL TECHNICAL SOCIETIES.

AMERICAN SOCIETY OF CIVIL ENGINEERS. Secretary, Chas. Warren Hunt, 220 West 57th St., New York. Annual convention, Cleveland, June 20-23. Next meeting, June 7, papers on reinforced concrete arches and on domes.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Secretary, F. R. Hutton, 12 West 31st St., New York. Annual meeting, Scranton, June 6-9.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, Ralph W. Pope, 95 Liberty St., New York. Annual convention, Asheville, N. C., June 19-23.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary, W. H. Merrill, Jr., Chicago.

AMERICAN INSTITUTE OF MINING ENGINEERS. Secretary, R. W. Raymond, 99 John St., New York.

AMERICAN INSTITUTE OF ARCHITECTS. Secretary, Glenn Brown, Washington, D. C.

ASSOCIATION OF ENGINEERING SOCIETIES. Secretary, Frederick Brooks, 31 Milk Street, Boston, Mass.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS. Secretary, W. M. Mackay, 235 Water St., New York. Annual meeting, Chicago, July 7 and 8.

CANADIAN SOCIETY OF CIVIL ENGINEERS. Secretary, Clement H. McLeod, 877 Dorchester St. Montreal.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Prof. M. S. Ketchum, University of Colorado, Boulder, Colo.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary, Prof. Edgar Marburg, University of Pennsylvania, Philadelphia, Pa. Annual meeting, Atlantic City, June 29-July 1.

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS. Secretary, George W. Tillson, Room 12, Municipal Building, Brooklyn, N. Y. Annual meeting, Sept. 5-9, Montreal.

ASSOCIATION OF RAILWAY SUPERINTENDENTS OF BRIDGES AND BUILDINGS. Secretary, S. F. Paterson, Concord, N. H.

AMERICAN RAILWAY ENGINEERING AND MAINTENANCE OF WAY ASSOCIATION. Secretary, L. C. Fritch, 1562 Monadnock Block, Chicago.

AMERICAN WATER-WORKS ASSOCIATION. Secretary, J. M. Diven, Charleston, S. C.

AMERICAN FOUNDRYMEN'S ASSOCIATION. Secretary, Richard Moldenke, P. O. Box 432, New York.

ENGINE BUILDERS' ASSOCIATION OF THE UNITED STATES. Secretary, J. L. Lyle, 39 Cortlandt St., New York.

AMERICAN PUBLIC WORKS ASSOCIATION. Secretary, W. H. Flint, Chattanooga. Annual meeting, Chattanooga, Aug. 30-31.

THE INTERNATIONAL RAILWAY CONGRESS.

The five sections of the International Railway Congress in Washington completed their work last week and the closing general session was held on May 13. Before that date some of the delegates from European countries left on tours of inspection of American railways and many others left Washington on similar trips immediately after adjournment. The attendance at the general meetings and the sessions of the sections was very large, while the admirable exposition of railway appliances was interesting as well as educational, and the numerous receptions and excursions enabled the delegates to become mutually acquainted. This acquaintance is not easily made between men of many nationalities and customs, and the good results of the Congress in this way deserve special mention.

As stated last week, the first section of the Congress devoted its attention to track and maintenance of way, the second to locomotives and rolling stock, the third to operation, the fourth to administration and financial subjects and the fifth to light railways. The meetings of these sections were not open to the public. The work of each section consisted of the discussion of reports on various subjects, most of which had been previously printed in the bulletin of the Congress. For example, one of the subjects of the first section was reinforced concrete, and the reporters were Mr. J. F. Wallace for America, Mr. Serge de Kareischa for Russia and Mr. W. Ast for other countries. The reporters presented summaries of their reports, and these were discussed and finally a set of "conclusions" on the subject were adopted for presentation at the general meetings if considered desirable. The officers of the several sections prepared abstracts of the proceedings for presentation before the general meetings, and these abstracts were published daily. The only "conclusions" on subjects within the field of this journal appear elsewhere in this issue.

It is to be regretted that the secrecy of these sectional meetings prevented the pubication of any full report of them. For example, there was a decidedly interesting discussion in Section I over a proposition by Mr. Ast to adopt a "conclusion" specifically mentioning Mr. Hennebique as the author of a reliable system of reinforced concrete construction. Only a faint indication of this debate was given in the official report, yet it aroused much severe criticism of the proposition to lend the good name of the Congress to the advancement of the Hennebique business.

THE CONVENTION OF THE AMERICAN WATER WORKS ASSOCIATION.

The American Water-Works Association held its annual convention at West Baden, Ind., last week, at the West Baden Hotel, an enormous structure of unique construction, built to accommodate the great number of visitors to the famous mineral springs of this place. The main building has a circular court 200 ft. in diameter covered with a glazed roof, supported by 24 semi-arch trusses meeting at a drum at the top. The bases of the ribs are connected by a ring of beams to take up the horizontal thrust of the ribs and rest on expansion plates on the tops of columns. About this court, six stories high, are grouped the galleries of rooms; these face either on the court or on the outside of the building, and number 708. The structure is fireproof, the only wood in it being the doors, windows and furniture. Connected with it are large baths, dining hall, ball room, gymnasium, theatre, kitchen, power house and other structures. It might be added that the springs, whose curative properties form the leading attraction of the place, are walled in by concrete, and it is found that the water of one of these springs softens the concrete quite rapidly. The analysis of this water is as follows: Sulphate of lime, 130.074 parts per million; sulphate of soda, 38.125; sulphate of magnesia, 33.335; carbonate of lime, 22.35; carbonate of soda, 11.64; carbonate of magnesia, 7.257; carbonate of iron and alumina, 3.607; chloride of sodium, 97.456; chloride of potassium, 7.358; chloride of magnesium, 11.037. The gases in an imperial gallon of the water are 11.116 cu. in. of carbon dioxide; 6.347 cu. in. of oxygen; 19.174 cu. in. of nitrogen and 2.505 cu. in. of sulphuric acid.

Fire Protection.—This convention marked 25 years of growth of the Association. Starting with 20 members at its first meeting in St. Louis, it now has nearly 500. Recently its committee work has been much improved and at present forms one of its most important features. This is particularly true of the work of the Insurance Committee, which has cooperated with the National Fire Protection Association and the International Association of Fire Engineers in devising a standard thread for fire-hydrant nozzles, and with the former organization in devising a mutually satisfactory specification for apparatus for detecting the flow of water in fire-protection mains running into industrial establishments.

The lack of a standard thread for hydrant nozzles has been one of the greatest defects of modern fire fighting conditions. Owing to it the steamers of one city are unable to render adequate assistance to another in case of serious conflagration. The work of the committee showed that the nozzles of perhaps nine-tenths of the cities of the country can be retapped to a 7¾ thread, and this was adopted as the Association's standard.

The metering of fire-protection mains has been strenuously opposed by fire-insurance engineers, and the Association's committee acknowledged that there were strong reasons for this opposition. The committees of the interested organizations finally decided to allow the use of detecting or metering apparatus which does not present a resistance to flow of more than 6 per cent. of the head. The Association adopted this recommendation.

It was brought out in the discussion that there are two such devices which have been developed for this particular service. One was designed by Mr. J. A. Tilden, of the Hersey Mfg. Co., Boston. In the main is hung a light check valve. The seat of this valve has a groove cut around it communicating with the open air through a meter or other measuring or detecting device. The valve is by-passed by a pipe containing a suitable meter for large flow. In this way any moderate draft on the main is supplied through the metered by-pass. The check is held down on its seat by the water pressure on an area equal to that of the air-filled groove, and when a demand for a large amount of water arises, this pressure is overcome and the check is lifted. As it is of light weight, the pressure required to keep it raised is trifling. As this device is intended for use on lines from which water is not supposed to be used for any purpose save fire-protection, the registering mechanism on the pipe connected with the groove in the seat may be of a different type from an ordinary meter, for it will be called into operation only on the rare occasions when the check is not seated. A test of this device at Lowell was described in this journal a few months ago.

The second device has been designed by Mr. E. B. French of the National Fire Protection Association. It consists of a check valve with a metered by-pass. The sizes of the by-pass and main are so selected that the former has one-tenth the capacity of the latter. The check is weighted, so that it will not open until the draft becomes heavy, when it is thrown up and, by this motion, shifts the registering apparatus of the meter on the by-pass so that it will indicate the total discharge instead of that of the by-pass.

The importance of this work of the Association's Committee was pointed out in the presidential address of Mr. Morris R. Sherrerd as follows: "There is one branch of the water-works field which is deserving of special and immediate attention. It is within the scope of this Association to review seriously the situation with regard to fire-protection engineering. This means more than a new name for an old subject; it means almost radical departure in some phases of water-works construction. Not many years ago, representatives of insurance interests requested that no street mains less than 6 in. in size be laid. Now the recommendation is: 'In general, mains supplying hydrants in important mercantile and manufacturing sections shall be of not less diameter than 12 in.; that all future installations of mains for the supply of hydrants in residential districts be of not less diameter than 8 in.' In making the above reference, it is not the purpose to discuss this and many similar radical suggestions which, I know, are the result of careful investigations. The best is none too good, and the position of the insurance men will assist each of us in having his recommendations for improvements sustained. On account of their point of view they are inclined, however, to take an extreme position. To reach such a high standard of perfection at once, or within several years, will require very large expenditures. Our individual duty is to see that every expenditure for the improvement of water systems for fire protection is made that is possible, and that all expenditures are applied along some systematic plan to obtain the best results."

Water Rates.—The subject of water rates always arouses warm discussion at the Conventions of the Association, and was brought up at the recent meeting by a paper by Mr. S. J. Rosamond, of Ft. Smith, Ark., on the method of determining a fair basis for rates for fire and domestic service. It contained some valuable data collected from privately owned works in many cities. The suggestion was made that as 33⅓ to 47 per cent. of the cost of a system is for fire protection as an extra to the cost of works for domestic service, the hydrant rental should yield fair interest on that proportion of the total cost of the plant plus the same percentage of the cost of maintenance. The water furnished without charge for flushing sewers, use in buildings and other public purposes should be considered independently of the fire protection service. The value of the water thus used is often far in excess, when estimated at the minimum rate, of the total hydrant rental paid by the city. Mr. Rosamond urged the reduction of this fire use and waste of water for public purposes. With respect to the charges for domestic and manufacturing purposes, he considered the only just system to be one based on the use of meters. He did not believe any flat rate, based on the frontage of the property, size of the house or number of fixtures could be adopted which would be fair to both consumer and company. He gave a large table of the flat rates in a number of cities and showed that in some cases these rates were too low to pay the cost of supplying water to some of the fixtures.

In an informal talk on the development of the Chicago water-works, Mr. John Ericson referred very interestingly to the necessity of introducing meters extensively in that city. In 1897, when he became city engineer, the supply was furnished by a number of practically independent works. He at once secured appropriations for about 50 miles of large mains, with which he connected the systems so that they could reinforce each other. He then made studies of the growth of the population and the increase in the per capita consumption, and estimated the pumping capacity needed at different future dates. The increase in this capacity was so great, that some less expensive alternative seemed imperatively required. After studying the effect of meters in checking waste in other cities, he reached the conclusion that by metering four-tenths of all the services in the city he could reduce the unpaid waste of water to such a

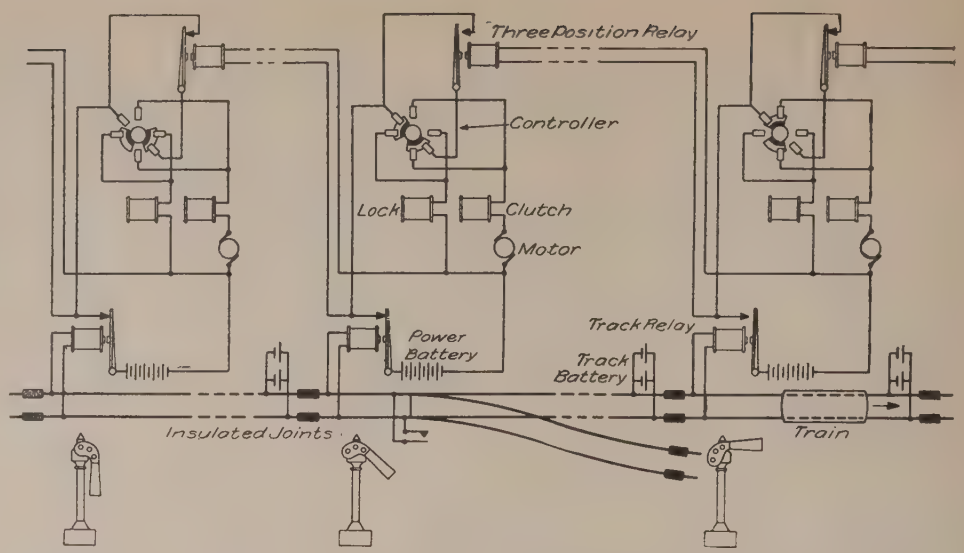
degree that the increase in pumping plant need be far less rapid.

This opinion expresses the view of most of those who discussed the subject of rates, as well as the prevention of waste. The only satisfactory way to charge for water is by meter measurement, on account of its justness to purveyor and consumer alike. Apart from this equity feature of the meter system is its repressive effect on waste, which in some cities may become of great importance.

Pumping Engines.—The paper by Mr. Hague, on the commercial pumping engine, was printed in this journal last week. A written discussion of it by Mr. Irving Reynolds dealt mainly with the design of details. For example, he suggested about 1 sq. ft. of valve area on both suction and discharge decks for each million gallons capacity, and advised the adoption of 4 in. as the maximum diameter for valves. In the course of the oral discussion, it was pointed out by several speakers, particularly by Mr. J. W. Alvord, that an economical pumping engine of small capacity was particularly desired. Engines of large size and high efficiency are now made commercially, but the pumps for small water-works are not economical.

A second paper on pumping was by Mr. Dabney H. Maury and discussed the use of steam turbines for driving centrifugal pumps. The construction of the De Laval, Westinghouse-Parsons and Curtis turbines was explained, and their efficiency when working with direct-connected centrifugal pumps was shown by a number of tables. In the discussion, Mr. Hague stated he had yet to learn of any turbine-centrifugal unit large enough to be considered a water-works pump which had an efficiency at all equal to that of a good pumping engine. Neither the steam nor the water end of such a unit had been tried sufficiently in such service to warrant their adoption for water-works purposes. He had personally been connected with the design of a pumping station in which the commission had installed, contrary to his advice, a high-lift centrifugal pump driven by electric motors, and the installation had proved decidedly uneconomical.

A third paper on pumps was by Mr. L. d'Auria and discussed the development of the type with the hydraulic compensator invented by him and described in this journal on Sept. 4, 1897. In this pump a reciprocating mass of water acts as a sort of motion-governing pendulum in producing a remarkably smooth-running engine, which has been put in actual service in two of the Philadelphia pumping stations without any special foundations to carry it. Views of a number of recent engines of large and small size were shown, and some results of tests of them were given.



Connections for Three-Position General Electric Automatic Block Signals for Double-Track Equipment.

Water Purification.—A paper on the use of copper sulphate in connection with iron in mechanical filtration, which was read by Mr. C. Arthur Brown, aroused considerable discussion. It described experiments made at the Anderson filtration plant, illustrated in this journal on Feb. 4, 1905, with iron sulphate containing 1 per cent. of copper sulphate as a coagulant. Comparative runs with iron sulphate with and without the small copper sulphate addition showed that the latter had a very marked effect. In the discussion of this paper Dr. W. P. Mason stated that it was not improbable some of the apparently unaccountable differences in the degree of purification attained with practically the same coagulant and raw water were due to variations in the physical condition of the coagulant. As for the use of sulphate of copper, which is unquestionably beneficial as an algaecide, there is some question concerning its daily application as a coagulant; Dr. Mason did not take any decided position for or against such use, but pointed out the necessity of careful experimental research before allowing sulphate of copper to enter the water continuously. Mr. Dow R. Gwinn stated that the Anderson results convinced him the use of iron and copper sulphates would solve a troublesome condition which occurred at times at Terre Haute, and he proposed to test the system.

Another paper describing experiments with copper sulphate was read by Mr. James M. Caird, who summarized the results as follows: 1. That 1 part of copper sulphate in 10,000,000 parts of water can be detected. 2. That copper sulphate when used in comparative strong doses will slightly reduce the color of the water. 3. That copper sulphate will reduce the alkalinity and increase the hardness of water. 4. That water to be filtered by the American process where alumina or iron and lime is used as a coagulant will be free from copper if the filters are properly operated. 5. That filtration without the addition of a coagulant does not remove the copper. 6. That the addition of lime will precipitate the copper. 7. That when iron is present it tends to interfere with the cyanide test for copper.

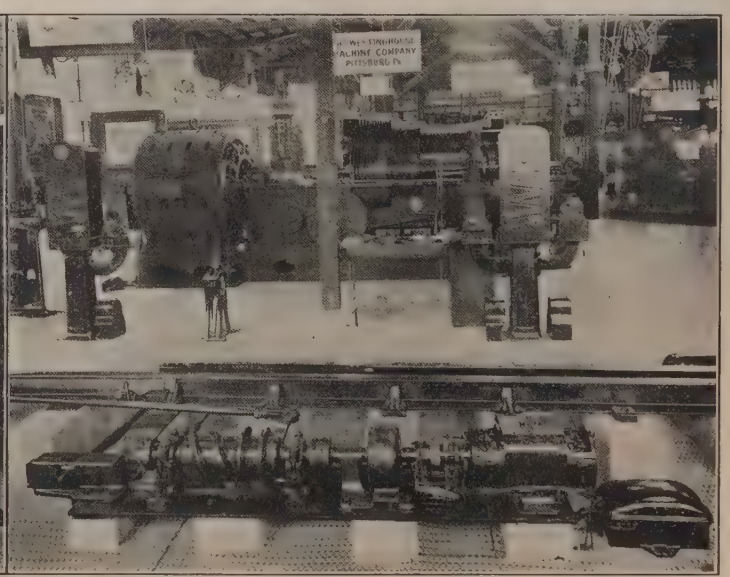
A third paper by Mr. F. B. Leopold was a voluminous discussion of typhoid fever epidemics due to contaminated water supply and contained many data useful to those desirous of investigating the importance of water purification. In the discussion, Dr. Mason pointed out the very great desirability of securing case as well as mortality records of such epidemics. He was convinced from such case records as he had been able to obtain, that the virulence of such epidemics would be found to depend in no small measure on the attenuation of the typhoid bacillus; the epidemics due to contaminated river water, in which the bacillus had perhaps been many days in the stream, were relatively mild in comparison with those due to contaminated well water and milk.

A fourth paper, by Mr. Rosamond, gave some interesting data concerning an extraordinary amount of sediment in the raw water for the supply of Fort Smith.

A related paper, by Mr. M. L. Holman, of St. Louis, was on the characteristics of pure water. It brought out very clearly the present uncertainty concerning the true physical properties of pure water, and gave a compilation of all the data relating to its density, relative volume and weight per cubic foot which the author could obtain. It is a highly valuable collection of notes.

Construction.—Under this head three papers were read. The first was a general description of the various sources of additional water supply for New York and was read by Mr. Wm. R. Hill. The second was by Mr. J. Waldo Smith, chief engineer of the Croton Aqueduct Commission, and gave a comprehensive account of the recent work on the new Croton dam and an explanation of the methods to be followed on the dams for the two new reservoirs in the Croton valley, one of which is described elsewhere in this issue. The novel feature of this work is the use of steel derrick towers which are permanently bedded in the masonry of the dam. The third paper was a description of the satisfactory experience of Mr. F. W. Cappelen with mineral rubber coating on steel pipe at Minneapolis, Seattle, Marquette and other places.

Exhibit of Union Switch & Signal Co., at Washington.



Switch Movement, Union Switch & Signal Co.'s Exhibit.

Miscellaneous.—Among the miscellaneous papers was one of much interest on the history of the Association, illustrated by lantern slides of many of the past officers. Another paper which aroused considerable discussion was a review by Mr. M. N. Baker of books useful for reference in the offices of a water-works plant. Another paper was an explanation by Dr. Mason of many interesting views of deep wells and allied subjects.

The election of officers of the Association for the ensuing year resulted as follows: President, Ben. C. Adkins, water commissioner, St. Louis, Mo.; vice-presidents, Charles E. Rowe, superintendent of water department, Dayton; Dabney H. Maury, consulting engineer, Peoria; George H. Felix, general manager of water department, Reading, Pa.; John B. Hein, superintendent of water department, Madison, Wis.; Alexander Milne, superintendent of water department, St. Catharines, Ont.; secretary and treasurer, J. M. Diven, superintendent of

water works, Charleston, S. C.; finance committee, H. E. Keeler, president Rogers Park Water Co., Chicago; Howard A. Dill, superintendent of water-works, Richmond, Ind.; A. A. Tucker, superintendent of water mains, Memphis. It was voted to hold the next annual meeting at Boston.

SOME OF THE ELECTRICAL EXHIBITS AT THE INTERNATIONAL RAILWAY CONGRESS.

One of the most important features of the International Railway Congress, at Washington, D. C., last week, to which reference was made in the last issue of this journal, was the exhibition of railway appliances. An excellent location was secured through a special act of Congress upon the Washington Monument grounds, on 14th, 15th and 16th Sts., near B St., which was convenient to the headquarters of the Railway Congress at the New Willard Hotel. A main exhibition hall was erected on 16th St., which accommodated about 200 exhibitors, while a number of manufacturers erected individual booths and displays which were very elaborate. The exhibition was also the scene of the introduction of several new departures in railway apparatus which had not previously been made public.

It was a matter of considerable comment at the Congress that the two most prominent exhibits at this gathering of steam railroad officials were those of the General Electric Co. and the Westinghouse Companies. The latter was the largest and most elaborate of any of the exhibits, being devoted to the many branches of the Westinghouse industries which are of interest to the railway field, and occupied an attractive and well appointed open exhibition building. In this building was located the Westinghouse Air Brake Co.'s exhibit, whose brake system and hose coupling apparatus was demonstrated by working models. The automatic hose coupling apparatus was arranged to show the provisions allowing for deviations in level of the car platform bodies and also for coupling upon extreme curves; this model was operated under service conditions with compressed air. A miniature model of two complete car trucks and frames fitted with air and steam and signal hose couplings and brake equipment was also shown. The Westinghouse magnetic brake was also shown in operation by means of a moving truck model, while the Westinghouse friction draft gear apparatus for heavy rolling stock was displayed on a testing rack which was equipped with an air cylinder for compressing it by a force of 15,000 lb.; the advantages of this rigging of a slow and serial release without recoil were well illustrated. The locomotive driver, brakes and automatic slack adjusters of the American Brake Co. were displayed, as well as the valves of various forms, and the various forms of steam and motor-driven air compressors. Other features of the Westinghouse exhibit that attracted attention were the 600 hp Westinghouse-Parsons turbine, with casing removed to expose the blades, Cooper Hewitt mercury lamps, motor-driven machine tools as adapted for heavy railroad shop work, and a full-sized working model of the new Westinghouse alternating-current railway motor equipment.

The exhibits of the various automatic and interlocking signal and switching devices of the Union Switch & Signal Co. in the Westinghouse pavilion included the well-known types of its electro-pneumatic and all-electric semaphore block signal and high-speed electric train staff systems, new forms of Kopp glass lenses and an important new system of all-electric interlocking of unusual interest. The exhibit of the company's train staff system was of especial interest in connection with the announcement of the contract recently awarded to this company for the equipment of about 110 miles of the Southern Pacific Railroad, between Rockwell and Truckee, with seventy-four high-speed absolute instruments and twelve permissive attachments, by far the largest order ever given for a train staff installation.

Electricity is the motive and controlling force for both the operation and the indication of the switches and signals in the new system of all-electric interlocking, which was demonstrated in the exhibit in an operative arrangement of a short-track section, complete with a full-sized railroad switch and switch lever, the latter fitted with an automatic device for completing the stroke after the switch has been operated. It has been a very easy matter to adapt electric motors to the operation of switches or signals, but it has been a problem of extreme difficulty to apply the all-electric system for certain and trustworthy operation of lever interlocking for the indication of the switch or signal operations. This problem has been satisfactorily solved in the system on exhibit by the use of currents of one character for the operation of switches and signals and currents of an entirely different character for actuating the indication mechanism. Direct current is used for the former, and alternating current for the latter purpose, both being obtained from the same source—generally a storage battery—the direct current being converted into alternating current at the proper time and in the proper circuit by a very simple method which adds nothing to the cost or complication of the apparatus. The use of currents of different character for operation and indication is an absolute safeguard against false indication which might otherwise result from faulty insulation, and the protection of the switches and signals against improper movement which might result from stray currents through faulty or broken-down insulation is secured by means of a magnet cut-out in connection with each switch and signal, which opens the circuit when a wire leading to it becomes crossed with a live wire, this cut-out acting independently without affecting any other switch or signal in the system, a decided improvement over anything heretofore known or used for the purpose. The motors for operating the switches and signals are of the rotating armature type, the armatures connected with the mechanism to be moved by means of electro-magnetic clutches, which afford a very simple and reliable means for connecting and disconnecting and are at the same time a safeguard against shocks against the mechanism which might result from the obstruction of the switch points in any way. The lever machine is operated by vertical alternating current motors, at the back, equipped with vertical shafts to which are applied ordinary ball governors, the indication latches on the lever quadrants being raised when the motors revolve and the governor balls fly apart, and the stroke of the lever being completed manually or automatically.

Three different forms of Union electric block signal semaphores are included in the operative display—a two-position automatic instrument, a three-position automatic instrument, and a two-arm interlocking signal. The Union all-electric signals have been widely installed since their introduction a few years ago, over 8,000 having been sold to date.

The exhibit of Kopp signal glass included important new forms of dioptric lenses, with five steps, to take the place of the lenses of three refraction steps formerly sold, the new design being introduced to eliminate any possibility of the distortion of refracting surfaces sometimes resulting in old-style lenses through the "settling down" of the three high steps so as to produce concave elevations. The absolute quality of the Kopp "solid-red" signal glass is demonstrated in an interesting manner at the exhibit through the use of a spectroscope pointed at Cooper Hewitt mercury vapor lamps hung overhead. The Cooper Hewitt lamp, as is well known, emits no red rays, and as Kopp "solid-red" lenses will transmit no other color, the brilliant actinic light of the mercury lamp is completely obscured when the Kopp glass is placed between it and the spectrum.

The General Electric Company had a handsome pavilion at one side of the entrance to the grounds which contained models of the latest form of Sprague-General Electric multiple-unit electrical train control; a small Curtis steam turbine, driving a small direct-current dynamo; magnetite lamps; mercury arc rectifiers and a model mine electric locomotive running on a short track outside, the locomotive being equipped with a reel to carry the double conductor cable for a metallic circuit system, instead of the single conductor with track return as heretofore.

The most attractive feature of the General Electric exhibit was the new railway block signalling system which was here placed before the public for the first time. It was with great interest that it was learned that the General Electric Co. has acquired all the patents, rights and special tools of R. Herman, covering his automatic electrically operated block-signal system, which will hereafter be known as the General Electric signal. The Herman signal has been in use for several years upon the Fort Wayne and Panhandle divisions of the Pennsylvania Lines west of Pittsburg and elsewhere, with very satisfactory results.

This system is entirely electrical and involves interesting features. The apparatus has been greatly improved and as now offered embodies many advantages of more than usual importance. The most important feature is perhaps the location of the signal mechanism at the top instead of at the bottom of the post; this does away with the heavy connections between motor and signal blade, as are necessary when the former is at the bottom of the post, and serves to reduce the friction and demand for power about two-thirds. This "top post" location permits the spectacle casting supporting the signal block to be directly attached to the main shaft of the mechanism.

The entire mechanism is very simple and delicate; contacts, spiral springs and sensitive adjustments have been avoided. The locking and clutching devices used in this signal are extremely simple and powerful, consisting of double-toggle levers with no sliding parts or objectionable sprockets and chains. While the lock magnet and mechanism are designed so that but little battery current is required to place and keep the signal in "clear" or "caution" position, the arrangement is such that a force several times greater than usual is applied to release the lock when the magnet is de-energized. The positive operation of this device can not be interfered with by the presence of gummy oil or the rusting of pins or bearings, as all parts are made from a special non-corrosive metal. The location of all moving parts at a distance from the ground obviates any difficulty from floods and prevents troubles that arise from surface moisture and fogs, which cause precipitation of water inside the mechanism cases of bottom post signals. This construction also lessens the liability of the accumulation of dirt inside the mechanism case, which is unavoidable when it is placed directly upon the foundation. All signals are designed to operate with a reduction of 33⅓ per cent. below normal voltage, thus obviating trouble that would otherwise occur on account of unavoidable variations in current conditions.

The company is prepared to build these signals in either the two or three position form, and, if desired, also in the bottom-post type of signal. The auxiliary apparatus that has been worked up for use in connection with complete systems of double-track block protection bears similar evidences of more than usual care, particularly in the case of the relay, which is of the double-pole type.

PERSONAL NOTES.

Mr. Clinton L. Shearer has been appointed city engineer of Beaumont, Tex.

Mr. W. G. Potter has been elected city engineer of Greensboro, N. C., succeeding Mr. J. M. Bandy.

Mr. Ed. E. Brice has become resident engineer on the Guelph & Goderich Ry., succeeding Mr. S. B. Clements.

Mr. Donald A. Duff has been appointed city engineer of Anacortes, Wash., to succeed Mr. S. D. Temple, who has resigned.

Mr. W. H. Arnold has been appointed superintendent of the floating equipment of the Bush Terminal Co., of Brooklyn, N. Y.

Mr. B. P. Bailey has been appointed superintendent of the Okmulgee, I T., water works, and has also been retained as electrical engineer of the Okmulgee Light & Power Co.

Prof. Chas. E. Rogers, of the Clarkson Memorial Polytechnic School, has accepted the chair of civil engineering at Trinity College. He is a graduate of the Rensselaer Polytechnic Institute.

Mr. J. R. Cullinane has succeeded Mr. John B. Quigley as general manager of the West St. Louis, Mo., water works, owned by a private company. Mr. Quigley is the owner of a water plant at Nevada, Mo.

Mr. Eugene W. Stern is consulting engineer to the architect, Mr. Kenneth Murchison, of the new Hoboken Terminal of the Delaware, Lackawanna & Western R. R., and designed the structural steel work of the terminal building, and will supervise its erection. This structure was recently described in this journal.

Mr. Henry A. Young has been transferred from the War Department to the U. S. Reclamation Service, and will serve in the capacity of engineer under Mr. H. N. Savage, of Billings, Mont. Messrs. Edward C. Gersbach and Frank E. Vey, recently appointed engineering aides in the Reclamation Service, and Mr. Ray Owen, engineering aid, have also been ordered to report to Mr. Savage at Billings.

The Secretary of War, on the recommendation of Gen. Mackenzie, chief of engineers, U. S. A., has appointed a board of engineer officers to consider the question of the general improvement of the navigation of the Ohio River from Pittsburg to its mouth. The board consists of Lieut.-Col. Daniel W. Lockwood, now stationed at Washington; Lieut-Col. Ernest H. Ruffner, stationed at Cincinnati; Lieut-Col. Clinton B. Sears, stationed at New Orleans; Maj. George A. Zinn, stationed at Wheeling, W. Va., and Maj. William L. Sibert, stationed at Pittsburg, Pa.

A commission of seven engineers has been appointed by the Philadelphia Rapid Transit Co., to determine the feasibility of extending the Market Street subway of that company under the Philadelphia City Hall. Mr. W. S. Twining, chief engineer of the company, has announced that the following men have been selected: Messrs. William H. Brown, chief engineer of the Pennsylvania Ry.; Joseph T. Richards, chief engineer, maintenance of way department, Pennsylvania Railroad; William Hunter, chief engineer, Philadelphia & Reading Ry.; W. B. Powell, city architect of Philadelphia; William C. Haddock, ex-director of public works of Philadelphia; John S. Stevens, ex-commissioner of public buildings in Philadelphia and president of the National Association of Builders; John Birkinbine, mechanical and designing engineer.

Col. W. L. B. Jenney has retired from active practice in architecture in Chicago and taken up his permanent residence in Los Angeles, Cal. He was educated in a French engineering school and after receiving a diploma from that institution, spent another year and a half in Paris. He returned to this country just prior to the Civil War and served five years as an engineer officer in the army, most of the time on the staffs of Generals Grant and Sherman. He was mustered out as brevet major, and in 1867 settled in Chicago, where he has been a prominent architect and engineer ever since. Col. Jenney was a pioneer in the use of structural steel in building construction and the Home Insurance Building, in Chicago, which was designed by him, was the earliest structure of the steel cage type. Many of the leading architects of Chicago have been engaged on his staff, and the business which he established will be continued under the firm name of Jenney, Mundie & Jensen, by Messrs. Jensen and Mundie, who have been in Mr. Jenney's office for twenty years.

CONTRACTING NEWS

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

WATER.

Notes Arranged Alphabetically by States.

Florence, Ala.—N. C. Elting, of Florence, who recently purchased the water works here, writes that it is proposed to extend the pipe lines.

Montgomery, Ala.—The time for receiving bids for constructing steel standpipe, also for constructing foundation for air compressor, pumping engine and making changes in and to the pumping station building, has been extended from May 15 to June 5. R. S. Williams, City Treas.

Ventura, Cal.—See "Power Plants, Gas and Electricity."

Trinidad, Colo.—The City Council is reported to be considering the expenditure of about $100,000 on water works improvements, including the laying of water mains.

Jackson, Ga.—See "Power Plants, Gas and Electricity."

Dawson, Ga.—It is stated that an election will soon be held to vote on issuing $80,000 bonds for the construction of water works and a sewerage system.

Chicago, Ill.—Bids will be received until May 31 by the Dept. Pub. Wks; (Jos. M. Patterson, Comr.) for furnishing and installing water tube boilers, complete, in the 39th St. Pumping Sta.

**Panoia, Ill.*—The Des Moines Bridge & Iron Wks., of Des Moines, is stated to have secured the contract for erecting a steel water tower for $3,497.

Elkhart, Ind.—The Lake Shore & Michigan Southern R. R. Co. (E. A. Handy, Ch. Engr., Cleveland, O.) is reported to be asking for bids for rebuilding and extending its private water works at Elkhart, Ind., estimated cost, $20,000. Also for the installing of 2 new pumps of 1,500,000-gal. capacity to be driven by electric motor.

Shellsburg, Ia.—D. M. G. Files, City Clk., writes that it is proposed to construct water works at a cost of $4,000. Engineers, National Constr. Co., of South Bend, Ind.

Milford, Ia.—W. W. Hendrix, of the Des Moines Bridge & Iron Wks., Des Moines, is reported to be preparing plans for water works for Milford.

Sedan, Kan.—H. A. Loomis, Jr., City Clk., writes that it is proposed to issue $35,000 bonds for water works. Engineer, T. Y. McFarland, of Sedan.

Newport, Ky.—W. Glazier, Supt. Water Wks., writes that G. W. Horning, of Cincinnati, O., is engineer for the construction of a 20-in. pipe line to connect Covington and Newport.

Hagerstown, Md.—The Blue Ridge Water Co., of Washington County, is reported incorporated by Jos. Roach, Henry B. Thomas, Douglas H. Duer and others, all of Baltimore, to supply water from a 400-ft. well on the premises of Jos. Roach to the cottages in the Blue Ridge summit resort region. The company will have a reservoir with a capacity of 20,000 gal., from which the water will be piped to the consumers' cottages.

Springfield, Mass.—The Water Comn. is stated to have decided on May 8 to construct new pumping station at Loon Pond, and make this an auxiliary supply for the summer.

Framingham, Mass.—The citizens are reported to have voted May 8 to purchase the plant of the Framingham Water Co.

Belding, Mich.—Bids will be received until June 5 by Wm. E. Fisher, City Clk., for furnishing materials and constructing water works, consisting of two 1,000,000 gals. pumping engines; two 100 h. p. boilers; one 100,000 gals. elevated water tower; 1,140 tons 4 in. to 12 in. c. i. pipe; 13, 6/10 tons special castings; 42 hydrants; 75 valves, 4 to 12 in.; pump house, wells, trenching and pipe laying; Riggs & Sherman Co., Engrs., 613 The Nasby, Toledo, O.

Clinton, Minn.—F. W. Watkins, Village Recorder, writes that it is proposed to construct water works at a cost of $6,000. Engineer, R. H. Chapman.

Foley, Minn.—It is stated that an estimate of cost will be secured for the construction of water works.

Preston, Minn.—It is reported that bids will be received by the Recorder until June 1 for furnishing material and laying 1,400 ft. of water mains.

Sauk Rapids, Minn.—The Village Council is reported to have authorized the Citizens' Com. to procure plans, estimates, etc., for water works.

Deer River, Minn.—Archie Stephenson, Village Recorder, writes that bids will be received May 23 at 8 P. M. for about 1,015 ft. 6-in. water main. Engineer, J. S. Potter, Grand Rapids, Minn.

Pine City, Minn.—There is some talk of constructing water works and a sewerage system here.

Cloquet, Minn.—The Council is reported to have under consideration the issuing of bonds for water works.

Duluth, Minn.—The Water and Light Dept. contemplates an extension of the water works to Minnesota Point in the near future.

Raymond, Miss.—It is proposed to construct water works here at a cost of $10,000. Engineer, Wm. F. Wilcox, Seutter Bldg., Jackson.

Neosho, Mo.—The Anheuser-Busch Brewing Assoc., of St. Louis, is reported to have decided to petition Council for a franchise for water works.

Carthage, Mo.—Burns & McDonnell, of Kansas City, are reported to be the engineers for water works to be constructed here, to cost about $175,000.

Dillon, Mont.—The City Trus. are reported to have under consideration the construction of a dam and reservoir.

Ft. Benton, Mont.—It is reported that contracts will soon be let for a 225,000 gal. reservoir for the water works.

Leigh, Neb.—C. H. Stockdale, H. P. Buhrnan and Geo. Boetel are stated to have been appointed a committee to investigate the cost of constructing water works.

Alma, Neb.—See "Power Plants, Gas and Electricity."

Charlestown, N. H.—Surveys are in progress for a gravity system of water works for the Charlestown Water & Sewer Co. (Frank W. Hamlin, Pres.) and plans will be ready about July 1. Engineer, A. W. Dudley, Manchester.

Newmarket, N. H.—Bids will be received until May 30 by the Bd. Selectmen (Chas. A. Morse, Chmn.) for laying about 2,100 ft. of 6-in. c. i. water pipe and installing 3 hydrants, with the necessary appurtenances.

Garfield, N. J.—The citizens are reported to have voted May 10 to purchase the plant of the Garfield Water Co. at a cost of $60,000 and extend its mains to portions of the town where there is no water supply.

New York, N. Y.—Mayor McClellan has approved the Legislative bill providing for a municipal commission to carry on the $100,000,000 water works improvements.

Brooklyn, N. Y.—Bids will be received May 24 (extension of date) by John T. Oakley, Comr. Water Supply, Gas and Electricity, N. Y. City for the following: Furnishing, delivering and laying water mains and appurtenances in Hicks, Joralemon, Furman and Willoughby Sts., tapping 20 and 30-in. water mains in service and hauling and setting 6-in. hydrants, service mains, fire hydrants and appurtenances in various streets in this Boro., and for furnishing and delivering pig lead.

**West Point, N. Y.*—Lieut. R. C. Foy, Acting Q. M., U. S. M. A., writes that the contract for furnishing about 3,000 tons of c. i. pipe and special castings (bids opened May 5) has been awarded to the U. S. Cast Iron Pipe & Foundry Co., 903 Land Title Bldg., Philadelphia, Pa., for all 6, 12 and 20-in. bell and spigot pipe, $25.35 per ton of 2,000 lbs. and all bell and spigot special castings, 2.6 cts. per lb.

New York State.—The Governor is reported to have signed the following bills: To legalize bonds at Goshen for a better water supply; legalize bonds of Alfred, for the construction of water works; to authorize Jamestown to acquire a water supply system; to establish a fire district in Waterford and provide for a supply of water; authorizing Buffalo to issue $500,000 bonds for extending the water works; enabling Brockport to maintain a system of water works; authorizing Saranac Lake to extend its water works and sewerage system; authorizing Silver Creek to issue $20,000 bonds, to enlarge its water works and authorizing Medina to expend $100,000 for new water works.

Niagara Falls, N. Y.—The Bd. of Pub. Wks. is reported to have instructed Corporation Counsel to prepare a proposition regarding a municipal water plant, to be submitted to voters. City Engr. Read is stated to have reported that the cost of placing the plant of the Niagara Falls Waterworks Co., which it is proposed to buy for $400,000, in proper condition, would be $161,000.

Middletown, N. Y.—T. Davey, Supt. of Water Wks., in his report to the Bd. of Water Comrs., recommends the construction of a larger filtered water reservoir or clear well at the filter plant; probable cost, $30,000.

Morehead City, N. C.—See "Power Plants, Gas and Electricity."

Ft. Caswell, N. C.—Lieut.-Col. R. H. Williams, Q. M., U. S. A., writes that all bids recently received for sinking a 6-in. tubular well here have been rejected, and new bids will be received for a 9-in. tubular well until June 14 as advertised in The Engineering Record. Specifications on file at office of Engineering Record, 114 Liberty St.

Bowbells, N. D.—The citizens are reported to have voted to issue $6,000 water bonds.

Newark, O.—J. P. Lamb, Pres. Bd. of Pub. Service, will receive propositions from Consulting Engineers up to May 24 for revising plans for a complete water works for this city. Plans to be revised were prepared 3 years ago and do not now meet the needs of the city. Estimate of cost of system $300,000. C. H. Wells, City Engr.

Cincinnati, O.—Bids will be received by the Bd. of Trus. Comrs. of Water Wks. June 13 for laying c. i. pipe and special castings and valves on several streets and avenues for the extension and betterment of the water distribution system, as advertised in The Engineering Record.

Lakewood, O.—Bids will be received until June 5 by the Bd. Trus. of Pub. Affairs (H. W. Burton, Clk.) for laying water mains in Matthews, Edanola and Sloan Aves. Wm. H. Evers, Eng. Co. Engrs., 237 Arcade Bldg., Cleveland.

Columbus, O.—The date of opening of bids for the construction of water softening and purification works has been extended from June 8 to June 15, as advertised in The Engineering Record.

Crestline, O.—Bids will be received by the Bd. of Pub. Affairs, June 5, for reservoir complete, c. i. water pipe, castings, etc., as advertised in The Engineering Record.

Cleveland, O.—Bids will be received by the Bd. Pub. Service until June 19 for the purchase and removal of 2 Cornish pumping engines and 6 Cornish boilers now located at the Fairmont Pumping Station, as advertised in The Engineering Record.

**Canton, O.*—M. W. Kellogg & Co., of New York, N. Y., are stated to have secured the contract for constructing a brick stack at the water works pumping station for $4,486.

Ontario, Ore.—Seymour H. Bell, of Sumpter, Treas. Ontario Electric Light Co., writes that it is proposed to construct water works at a cost of $35,000, to be done by days' work. Engineer, T. E. Preston, of Ontario, Ore.

**Wasco, Ore.*—Mears & Gould, of Hood River, are stated to have secured the contract for constructing water works and sewerage system for Wasco.

Philadelphia, Pa.—Local press reports state that according to the estimate of Engr. Hill, Ch. of the Filtration Bureau, about $3,800,000 is necessary to complete the work of filtering the entire water supply. He has completed the plans for increasing the capacity of the Belmont and Roxborough filter plants.

Woonsocket, R. I.—Bids will be received until May 29 by the Bd. Water Comrs. for a pumping engine having a capacity of 5,000,000 gals. F. H. Mills, City Engr.

Columbia, S. C.—The citizens are reported to have voted to issue $400,000 bonds for water works.

Lake Andes, S. D.—C. M. Renshaw is reported to have petitioned for a franchise for water works.

South Shore, S. D.—Wm. H. Johnston, City Clk., writes that a petition has been presented to the Bd. of Trus. to call an election to vote on the construction of water works, but no definite action has yet been taken.

Texas.—W. P. Bullock, of Longview, Tex., is Consulting and Designing Engr. for water works to be constructed at the following places in Texas: Longview, to cost $44,000; Jacksonville, $28,000; Grand Saline, $16,000 and Athens, $38,500.

Mineral Wells, Tex.—This city is reported to have issued $6,000 water works bonds, which the State Attorney General has approved.

Galveston, Tex.—Rudolph Hering, of New York, N. Y., in his report to the City Comrs. on the city water works, is stated to have recommended the laying of a duplicate main where present main crosses the bay and the construction of storage tanks.

**Ogden, Utah.*—The Twin Falls Co. (H. Filer, Mgr.) is reported to have awarded to Corey Bros. Constr. Co., of Ogden, the contract for 37 miles of canal for irrigation, etc., around Shoshone, including 1,500,000 yds. earth excavation; contract price about $140,000.

Brattleboro, Vt.—A committee is stated to have been appointed to procure a larger and better water supply and has selected E. E. Davis, an engineer of Northampton, to assist the committee.

Burlington, Vt.—H. M. McIntosh, City Engr., writes that a committee has been appointed consisting of Dr. J. B. Wheeler, Dr. F. E. Clark, Alderman J. E. Meagher and others to investigate the question of constructing a filtration plant.

Bristol, Vt.—Bids will be received by the Water Com. (F. H. Palmer, Chmn.) for furnishing material and constructing a gravity system of water works, as advertised in The Engineering Record.

Northfield, Vt.—Bids will be received until June 6 for pipe, pipe laying, covered concrete reservoir, valves and hydrants, special castings, gate boxes, etc., for the constructing of a water system. For specifications apply to Chas. A. Edgerton, Secy. Comrs.

Petersburg, Va.—G. B. Gill, City Aud., writes that plans are being prepared for extension of the sewerage system and water works and the renewing of the sidewalks; about $75,000 will be expended. Engineer, R. D. Budd.

Bristol, Va.—The City Council is reported to have recommended the purchase of 200,000 gal. water per day, from the Durham-Cutler Co., which proposes constructing water works in Bristol.

**Seattle, Wash.*—The contract for laying c. i. water mains on Western Ave. and other streets (bids opened Apr. 29) has been awarded to Stirrat & Goetz, 406 Washington Bldg., Seattle, for $101,073.

Bids will be received until May 27 by C. B. Bagley, Secy. Bd. Pub. Wks., for water main in Summit Ave. N., cost, $6,650; concrete walks on E. Columbia St., cost, $15,200, and grading 24th Ave. N., cost, $8,150.

Ft. Wright, Wash.—The following are the bids opened on May 1 by Capt. Edw. A. Shuttleworth, Constr. Q. M., U. S. A., for (*a*) reservoir (*b*) pipe line (*c*) pump house (*d*) pump, etc., and (*e*) totals at Ft. Wright: International Fireproof Constr. Co., Seattle, *a* $8,000; Harry A. Cotton, Port Townsend, Wash., *a* $7,400, *b* $5,250, *c* $2,346; John J. Dwyer, St. Paul, Minn., *a* $9,222, *b* $5,348, *c* $1,700, *d* $3,800, *e* $20,070; Kilbourne & Clark, Seattle, *d* (2 bids) $4,919, and $3,717; K. G. Lundstrom, Portland, Ore., *a* $15,677; N. C. Naylor, Lewiston, Idaho, *a* (2 bids) $9,940 and $9,250, *b* $4,860, *c* $2,600, *d* $5,750, *e* $23,150; I. J. Bailey & Co., Wenatchee, *a* $14,870, *b* $6,870, *c* $3,020, *d* $5,120, *e* $29,880; Nixon & Kimmel, Spokane, *d* $5,548; Burrell Constr. Co., Seattle, *a* $7,708, *b* $3,085, *c* $2,096, *d* $4,097, *e* $16,986; Jas. C. Broad, Spokane, *a* $10,765, *b* $6,965, *e* $1,565, *d* $5,495, *e* $24,790.

**Depere, Wis.*—Contracts for constructing water works (bids opened May 4) are stated to have been awarded as follows: C. i. pipe and special castings to the U. S. Pipe & Fdy. Co., Chicago, Ill., for $10,309; hydrants, valves and valve boxes, to the Ludlow Valve Co., Troy, N. Y., for $1,353; pipe laying to Walter O. Bahr, Manitowoc, $5,620; two 50,000 gal. elevated tanks to the Chicago Bridge & Iron Co., Chicago, Ill., $8,300; 2 concrete storage reservoirs, tower foundations and well manholes, to Miner & Larsen, Richland Center, $2,108, and two power houses, Derks & Cremers, $1,400.

Wauwatosa, Wis.—See "Power Plants, Gas and Electricity."

West Allis, Wis.—Chas. J. Poetsch, City Engr. of Milwaukee, is stated to have been selected to supervise the installation of water works in West Allis.

Bids will be received until May 24 by the Village Bd. for $60,000 bonds for constructing a system of water works and water mains; H. D. Hill, Village Clk.

Guantanamo, Cuba.—Bids will be received until June 24 by Mordecai T. Endicott, Ch., Bureau Yards and Docks, Navy Dept., Washington, D. C., for a reinforced concrete reservoir and water-distributing system at the Naval Station, Guantanamo.

Brantford, Ont.—It is stated that bids will be received until May 27 by the Water Comrs. for 3 boilers to be installed in the pumping station. Fred. W. Frank, Secy.

SEWERAGE AND SEWAGE DISPOSAL.

Notes Arranged Alphabetically by States.

**Birmingham, Ala.*—The Jefferson Constr. Co. is stated to have secured the contract for constructing a septic tank on the village creek trunk sewer for $6,607.

San Francisco, Cal.—The Bd. of Superv., on May 5, sold bonds to the amount of $100,000 for sewers and $50,000 for schools.

Ventura, Cal.—See "Power Plants, Gas and Electricity."

**Items marked thus give the names of parties awarded contracts.*

Waterbury, Conn.—Bids will be received until June 20 by the Bd. Pub. Wks. for constructing Section I of the Main Carrier, a reinforced concrete and brick intercepting sewer 4 ft. 6 in. x 4 ft. 5 in., as advertised in The Engineering Record.

Danbury, Conn.—It is stated that bids will be received until May 24, by A. L. Davis, City Engr., for constructing a sewer and appurtenances in Terrace Pl.

New Haven, Conn.—It is stated that bids will be received until May 23 by C. W. Kelly, City Engr., for constructing sewers in W. Carlisle St.

Dawson, Ga.—See "Water."

Boise, Idaho.—Godfrey Sperling, City Engr., writes that some sewer lateral and paving work is in contemplation, but nothing definite has yet been done.

Rockford, Ill.—Bids will be received until June 6 by the Pres. of the Bd. Local Improv. for constructing sewers in portions of 3d, 6th, 7th, 12th and S. Main Sts. and 9th, Oakwood and Forest Aves., as advertised in The Engineering Record.

Greensburg, Ind.—Contracts will probably soon be let by the City Council for the construction of a sanitary sewer, to cost about $130,000.

Arcadia, Ind.—Bds will be received May 25 by the Bd. Trus. (D. B. Dickover, Pres.) for constructing a sewer in a portion of Main St.

Des Moines, Ia.—The City Council is reported to have decided to ask for new bids for constructing the Ingersoll Run sewer, bids for which were previously opened Mar. 11. W. W. Wise, Chmn. Bd. Pub. Wks.

Ackley, Ia.—A stock company is reported organized here to construct a sewerage system and sewage disposal plant.

Detroit, Mich.—Mason L. Brown, 821 Chamber of Commerce Bldg., Detroit, is reported to have completed plans for a sewerage system for the village of Ford, to cost about $50,000.

Lansing, Mich.—The following are the bids recently received for sewers on Water and other streets: M. E. Fitzpatrick, $22,900; W. H. McKale, $23,420, and J. H. Algate, $24,017.

Deer River, Minn.—J. S. Potter, of Grand Rapids, Minn., is preparing plans for a sewerage system.

Pine City, Minn.—See "Water."

Duluth, Minn.—Petitions have been filed with the Bd. of Pub. Wks. for construction of sewers on Minnesota Ave., Park Point, and the City Engr. will prepare plans and estimate of cost.

Pipestone, Minn.—S. W. Funk, City Recorder, writes that bids will be opened May 20 by the Common Council, for constructing certain sewers and appurtenances, to comprise approximately 1,264 lin. ft. 18-in., 1,620 lin. ft. 15-in., 4,122 lin. ft. 12-in., 1,603 lin ft. 10-in. pipe sewer, 7 straight and 16 junction manholes; separate bids will be received for a reinforced concrete septic tank; probable cost, $15,000. Loweth & Wolf, Engrs., St. Paul, Minn.

Lake City, Minn.—Bids will be received May 27 by the Common Council for excavating and laying 8-in. sewer pipe in portions of Prairie and Elm Sts.; A. Corwin, City Recorder.

Austin, Minn.—Bids will be received until May 26 by T. M. Foster, City Recorder, for constructing a storm sewer in Main St., in all about 1,294 ft. of 12, 15, 18 and 20-in. pipe; also for an 8-in. sanitary sewer in a portion of Freeborn and Cherry Sts., in all about 2,256 ft.

Gulfport, Miss.—Plans will probably be completed about June 1 by Wm. F. Wilcox, Seutter Bldg., Jackson, for the proposed sewerage system; probable cost of work, $20,000.

Plainfield, N. J.—Bids are wanted June 5 for furnishing material and constructing improvements to the sewage disposal works, as advertised in The Engineering Record.

Jersey City, N. J.—The Street & Water Bd. is reported to be considering the construction of a sewer in Van Winkle St., at a probable cost of $32,000.

Asbury Park, N. J.—Bids will be received by the Dept. of Water and Sewer May 22 for constructing about 3,500 ft. 18-in. sewer, as advertised in The Engineering Record.

New York, N. Y.—Bids will be received until May 31 by John F. Ahearn, Pres. Manhattan Boro., for furnishing material and constructing a sewer in a portion of Washington, Greenwich, Morris and E. 24th Sts. Engineer's estimate, 1,058 ft. brick sewer, 4 ft.x2 ft. 8 in.; 1,037 4-ft. brick sewer; 110 M. ft. timber and planking for bracing and sheet piling, etc.

Brooklyn, N. Y.—Bids will be received until May 31 by Martin W. Littleton, Pres. Brooklyn Boro., for furnishing material and constructing sewers in portions of Greenpoint, 4th and Albany Aves. Engineer's estimate: 243 lin. ft. 24-in. pipe and 1,847 lin. ft. 12-in. pipe sewer, 17 manholes, etc.

New Brighton, S. I., N. Y.—Bids will be received until May 23 by Geo. Cromwell, Pres. Boro. Richmond, for furnishing and delivering earth pipe and tile as required to any point in Boro. Richmond. Engineer's estimate: 500 lin. ft. each of 24, 20, 18, 15, 12, 10 and 4 in. pipe; 10,000 lin. ft. 4-in. agricultural drain tile (porous), complete with collars.

Ballston Spa., N. Y.—The date of opening of bids for the construction of about 8 miles of sewers has been extended from May 18 to May 25, as advertised in The Engineering Record. Engineer, John M. Farley, 5 Court St., White Plains.

Buffalo, N. Y.—The Sewer Com. of the Aldermen has decided to report in favor of awarding to Wm. Franklin, the contract for the construction of a sewer in Hertel Ave. for $18,900.

Bids will be received until May 31 by the Dept. Pub. Wks. (Francis G. Ward, Comr.), for constructing sewers in portions of several streets, including 10, 12, 15, 18 and 20-in. tile.

Mingo Junction, O.—The City Council is reported to have adopted plans for the Church Hill sewer.

Wasco, Ore.—See "Water."

Newark, O.—Bids will be received until May 26 by the Bd. Pub. Service (Frank T. Maurath, Clk.) for furnishing materials and constructing a sanitary sewer in Oakwood Ave., requiring 2,930 lin. ft. 24 and 1,800 lin. ft. 6-in. sewer, 60 lin. ft. 24-in. c. i. water pipe, 6 manholes, 1 lamphole and 6 catch basins; also on Gay St., requiring 1,200 lin. ft. 8 and 480 lin. ft. 6-in. sewer, 4 manholes and 1 combined manhole and flush tank.

Norwood, O.—W. E. Campbell, City Clk., writes that it is proposed to construct a sewerage system. Engr., Jas. A. Stewart, Traction Bldg., Cincinnati.

**Fremont, O.*—Faragher & Randall, of Lorain, are stated to have secured the contract for constructing the east side trunk sewer ((bids opened May 9) for $19,135.

Columbus, O.—Bids will be received May 31 by the Bd. Pub. Service (Chas. H. Frank, Secy.) for furnishing materials and constructing the South Side Sanitary Sewer, Sec. B. Engineer's estimate, approximately: 2,331 lin. ft. 24x36-in. 1½ ring brick sewer, complete except back-filling; 12 lin. ft. c. i. sewer; 134 lin.. ft. 10-in. vitr. pipe sewer; 200 lin. ft. 15-in. vitr. pipe storm drain, etc; also same date for furnishing materials and constructing the Eldon Ave. storm sewer; Julian Griggs, Ch. Engr., Bd. Pub. Service.

Akron, O.—The Council is reported to be considering the construction of an intercepting sewer in South Akron to cost about $40,000.

Middletown, O.—The Bd. of Pub. Service is stated to have on May 9 authorized the City Engr. to prepare plans for a sewer in N. Broad St. It also approved plans for sewers in other streets.

Marion, O.—It is reported that bids will be received until May 24 by the Bd. Pub. Service (Wm. Fies, Clk.) for constructing sewers in several streets.

Ravenna, O.—Plans have been presented to the State Bd. of Health at Columbus by this village for a sewerage system and sewage disposal plant. As soon as plans have been approved work will begin. Engr., W. E. Myers, Kenton; S. J. Post, Village Clk.

Cleveland, O.—Bids will be received May 25 by the Bd. Pub. Service (A. R. Callow, Secy.) for constructing sewers and culverts in portions of several streets.

Mansfield, O.—Bids will be received until June 1 by the Bd. Pub. Service, for improving portions of several streets requiring 10,170 lin. ft. 8 in. and 580 lin. ft. 6-in. sanitary sewer; 1,220 lin. ft., 20, 22, 24-in. storm water sewer; E. 3d St. culvert; 600 cu. yds. excav., 400 cu. yds. concrete, 1,600 lbs. steel bars 1¼x¼ in., etc.

Bids will be received until June 7 by D. S. Koontz, City Aud., for $10,600 sewer improvement bonds; also for $4,200 bonds for constructing an arch over Ritters Run on 3d St.

Cincinnati, O.—Bids will be received by the Bd. Pub. Service (Geo. F. Holmes, Clk.) for furnishing materials and constructing sewers and drains in a portion of Colerain Ave.

El Reno, Okla. Ter.—It is reported that esimates are being prepared for a sewerage system to cost $20,000.

Titusville, Pa.—Bids will be received May 22 for the construction of about 3,000 ft. of 15-in. tile in the 4th Ward. H. A. Holstein, City Engr.

**Faulkton, S. D.*—The contract for constructing a sewerage system is reported to have been awarded to Jones & Roederich, of Canton, for $9,122.

Petersburg, Va.—See "Water."

Seattle, Wash.—See "Paving and Roadmaking."

Richmond, Wis.—The estimated cost of constructing a sewer on 3d St. is reported to be $7,000.

Oconto, Wis.—Bids will be received until June 17 by the Bd. Pub. Wks. for furnishing material and constructing sewers in the city during the season of 1905, as advertised in The Engineering Record.

Merrill, Wis.—It is stated that bids are wanted May 31 by the Bd. Pub. Wks. for constructing sewers. B. J. Lambert, City Clk.

West Allis, Wis.—Bids will be received until May 24 by the Village Bd., for $15,000 bonds, for constructing a sewerage system; H. D. Hill, Village Clk.

BRIDGES.

Notes Arranged Alphabetically by States.

**Saybrook, Conn.*—The New York, New Haven & Hartford R. R. Co. (Colin M. Ingersoll, Ch. Engr., New Haven) is stated to have awarded the contract for constructing substructure of the drawbridge to be built over Connecticut River to Daly & Holbrook, of Mt. Kisco, N. Y., the cost of complete structure is about $1,300,000.

Indianapolis, Ind.—It is reported that bids will be received by the Co. Comrs. for constructing the Emrichsville Bridge across White River.

Plymouth, Ind.—It is stated that bids will be received until June 5 by H. L. Singrey, Co. Aud.

Versailles, Ind.—It is reported that bids will be received until June 5 by the Bd. Co. Comrs., for constructing a double arch stone bridge over Graham Creek in Shelby Township; Nicholas Volz, Co. Aud.

Rockville, Ind.—It is reported that bids will be received until June 10 by the Bd. Co. Comrs. for repairing and constructing cement arch and steel bridges throughout the county; Henry Grubb, Co. Aud.

Lafayette, Ind.—Bids will be received by the County Comrs. June 7 for the construction of a 125-ft. span bridge, either of steel or concrete arch. G. H. Stevenson, Co. Surv.

Ft. Wayne, Ind.—The County Council is stated to have appropriated $17,000 for the rebuilding of the bridge over Maumee River at Bull Rapids.

Boston, Mass.—Bids will be received May 23 by the Cambridge Bridge Comn. (Patk. A. Collins, Chmn.) for furnishing and erecting c. i. fascias for Cambridge Bridge; Wm. Jackson, City Engr.

It is stated that bids will be received until May 25 by Wm. Jackson, City Engr., for constructing abutments and retaining walls of Boston approach to Brookline St. bridge.

Cadillac, Mich.—Bids will be received by the Bd. of Pub. Wks., June 20, for the construction of Long Boulevard Bridge, as advertised in The Engineering Record.

Fulton, Miss.—It is reported that the Bd. Co. Superv. (D. R. McDougal, Clk.) will receive bids until June 5, for constructing a steel bridge over the Tombigbee River on the Fulton and Tupelo Road, about 2 miles west of here.

Ellisville, Miss.—See "Paving and Roadmaking."

Ainsworth, Neb.—Bids will be received June 15 by the Bd. Co. Comrs, for constructing an under truss bridge over the Niobrara River at the site of the McLain Bridge, to consist of six 36-ft. spans and a 12-ft. roadway; and to include ice breaks; E. B. Smith, Co. Clk.

**Jersey City, N. J.*—F. M. Stillman & Co., of 26 Exchange Pl., are stated to have secured the contract for constructing a highway bridge over Bowers St. at Ogden Ave. for $7,848 (bids opened by Bd. Chosen Freeholders on May 4.)

New York State.—The Governor is stated to have signed the following bills: To legalize construction of a bridge over Hudson River, between Glens Falls and South Glens Falls, at a cost of $14,944; also to legalize the issue of $5,000 bonds to reconstruct a bridge over Schroom River at Schroom.

**Middletown, N. Y.*—Chas. H. Smith, County Engr., writes that the contract for tearing out abutment of Pellet Island bridge and building a new stone pier on pile foundation (bids opened May 15) has been awarded to Horseheads Constr. Co., of Horseheads, for $2,300.

Medina, O.—The County Comrs. are stated to have rejected all bids opened May 1 for constructing a bridge over Rocky River in Liverpool Township. According to reports new bids will be received on new specifications, as the other bids did not state the material to be used for roadways.

Marion, O.—Bids will be received until June 6 by the Co. Comrs. for furnishing material and constructing the concrete masonry abutments and wing walls estimated to contain 600 cu. yds., and approaches to the bridge across Scioto River in Pleasant Township to be known as "Newman Bridge"; bids, including plans, will also be received at the same time for the steel superstructure of said bridge, to consist of 1 span, 188 ft. long and roadway 18 ft. L. M. Hipsher, Co. Aud.

Mifflintown, Pa.—It is stated that bids will be received until June 3 by the Bd. Co. Comrs., for constructing a stone and cement bridge over the Juniata River.

Waterford, Pa.—Bids will be received June 1 by A. J. Yaple, Comr. Greene Township, Waterford, R. F. D. No. 3, for constructing an iron bridge, about 420 ft. long and roadway 20 ft. wide, with abutments over Four-Mile Creek, at Kane Gulf.

Doylestown, Pa.—It is reported that bids will be received until May 29 for constructing a stone arch bridge over Core Creek in Middletown Township; T. A. Cronthamer, Co. Clk.

Lancaster, Pa.—Bids will be received June 5 by the Bd. Co. Comrs. of Chester and Lancaster Cos., at Lancaster, for constructing a steel inter-county bridge over Octoraro Creek, at Griests Fording; M. G. Schaeffer, Co. Compt., Lancaster.

Berwick, Pa.—The State Bd. of Pub. Grounds and Bldgs. is stated to have approved the revised plans for a bridge to be constructed over Susquehanna River between Berwick and Nescopeck. According to reports bids will soon be received.

Reading, Pa.—Bids will be received until May 26 by the Co. Comrs. for constructing a bridge across Saucony Creek in Greenwich and Richmond Townships, known as Heffner's Bridge. Bids will be received on a steel truss superstructure with concrete roadway; also for masonry work. H. F. Livingood, Co. Compt.

Chamberlain, S. D.—See "Railroads."

**Green Bay, Wis.*—Greiling Bros., of Green Bay, are stated to have received the contract for constructing substructure of the steel bridge to be constructed over Fox River for about $40,000.

Milwaukee, Wis.—The County Bd. of Supervisors is stated to have passed an ordinance providing for the issue of $450,000 bonds to construct a viaduct on Grand Ave.

East Toronto, Ont.—The Toronto & York Radial Ry. Co. (W. H. Moore, Gen. Mgr., Toronto), is reported to be considering constructing a bridge over the tracks of the Grand Trunk Ry. Co. at a cost of $8,000.

Perth, Ont.—It is stated that bids will be received until June 6 by Wm. Davidson, Co. Clk., for constructing a steel bridge across Thames River; also for abutments and wing walls for same. John Roger, Engr., Mitchell, Ont.

Cresley, Ont.—It is stated that bids will be received until June 17 by Wm. McDonald, Warden, Cresley, for constructing a steel bridge 230 ft. long, a pier consisting of about 175 cu. yds. and 2 concrete abutments consisting of about 500 cu. yds. Jas. Warren, Engr., Walkerton.

PAVING AND ROADMAKING.

Notes Arranged Alphabetically by States.

Los Angeles, Cal.—The Council has ordered plans prepared for the paving of San Pedro St. and Central Ave., with sheet asphalt. Harry F. Stafford, City Engr.

Denver, Colo.—All bids opened Apr. 21 by the Bd. of Pub. Wks. for grading, curbing and surfacing the West Side Improvement Dist. No. 1 are stated to have been rejected.

Wilmington, Del.—Bids will be received May 23 by the Bd. Dirs., Street and Sewer Dept. (L. V. Christy, Secy.) for furnishing material and paving a portion of Church St.; approximately 2,500 sq. yds. granite blocks.

Washington, D. C.—C. B. Hunt, Engr. of Highways, D. C., writes that the following are the bids opened May 12 for (*a*) 14,000 sq. yds. asphalt paving, (*b*) 2,300 sq. yds. vitr. block gutter, (*c*) total: Brennan Constr. Co., *a* $1.46, *b* $1.18, *c* $23,154; Cranford Paving Co., *a* $1.63, *b* $1.21, *c* $25,603; Barber Asphalt Paving Co., *a* $1.64, *b* $1.29, *c* $25,927.

**Items marked thus give the names of parties awarded contracts.*

Boise, Idaho.—See "Sewerage and Sewage Disposal."

Belvidere, Ill.—It is stated that bids are wanted about Aug. 1 for macadamizing about ½ mile on Pearl St. Probable cost, $16,000.

Geneseo, Ill.—The Rock Island Concrete Constr. Co. of Rock Island is stated to have received the contract for construction of 150,000 sq. ft. of concrete sidewalks in Geneseo for about $20,000.

Wilmette, Ill.—It is reported that bids will be received until May 24 by the Bd. Local Improv. for grading, curbing and paving with brick a portion of North Ave.; W. S. Shields, Engr., Rm. 1715, Marquette Bldg., Chicago.

Vincennes, Ind.—Bonds amounting to $57,836 are reported sold for constructing roads in Knox County.

Mishawaka, Ind.—The Common Council is stated to have passed resolutions providing for the paving of 14 streets with Warner Bros. bitulithic paving composition. The probable cost of paving the 5 miles of streets is $260,000.

Evansville, Ind.—It is stated that the Bd. of Pub. Wks. will soon receive bids for paving portions of Water St. with brick and asphalt.

Rockville, Ind.—It is reported that bids will be received until June 5 by the Bd. Co. Comrs., for improving Bridgeton, Carbon, Irwin and Lay roads, Racoon Township, by grading and graveling. Henry Grubb, Co. Aud.

Bedford, Ind.—It is stated that bids will be received until June 5 by the Co. Comrs. for constructing 17,875 ft. gravel or macadamized roads. Walter G. Owens, Co. Aud.

Council Bluffs, Ia.—The City Council has ordered 50,000 sq. yds. brick paving, and contracts for same will probably be let the latter part of June. S. L. Etnyre, City Engr.

Iowa City, Ia.—The City Council is stated to have passed a resolution providing for the paving of Iowa Ave. with Warren Bros. bitulithic paving, at an estimated cost of $50,235. Also a resolution providing for the paving with brick about 6,022 sq. yds. on College and Capitol Sts., estimated cost, $11,835.

Emporia, Kan.—It is reported that bids are wanted until June 5 for grading, curbing and paving portions of Union and State Sts.; G. O. Mathewson, City Clk.

Hutchinson, Kan.—It is stated that bids are wanted June 1 by T. G. Elbury, City Engr., for 30,500 sq. yds. brick and concrete paving and cement curbing.

New Orleans, La.—Bids will be received until May 29 by Chas. R. Kennedy, City Compt., for paving with asphalt, portions of Josephine and Carondelet Sts.; Capt. W. J. Hardee, City Engr.

**Lynn, Mass.*—Horace R. Parker, Clk. Bd. Pub. Wks., writes that the contract for furnishing about 100,000 sidewalk paving brick (bids opened Apr. 18) has been awarded to J. Lawrence Martin, of Boylston St., Boston.

**Pittsfield, Mass.*— Richmond F. Hudson, of Melrose, is stated to have secured the contract for constructing the state highway between Pittsfield and Lenox for $9,777.

Traverse City, Mich.—Bids will be received until June 2 by the Bd. Pub. Wks. for furnishing material and paving on State St., approximately 11,545 sq. yds., with brick, asphalt, Warren bitulithic or bituminous macadam, including 5,580 lin. ft. curbing, as advertised in The Engineering Record.

Partridge, Minn.—Bids will be received May 22 by the Town Bd. Supers., (F. M. Rodenberger, Chairman), for $4,500 road improvement bonds.

Minneapolis, Minn.—It is stated that a portion of Central Ave. will be paved with brick at an estimated cost of $1.95 per yd.

Crookston, Minn.—It is stated that bids will be received until June 1 by the Co. Comrs. for constructing 2 approaches to bridge across Red River in Mallory. N. A. Hoffard, Co. Aud.

Grenada, Miss.—It is stated that bids will be received until June 5 by C. B. Bolton, City Engr., for about 25,000 sq. ft. granolithic sidewalks.

Ellisville, Miss.—The Bd. of Supers. of Jones County is stated to have decided to expend $20,000 on roads and bridges.

**Greenville, Miss.*—The contract for constructing about 600,000 sq. ft. of granolithic sidewalks is stated to have been awarded to Rudolph S. Bloome & Co. of Chicago, Ill., at 12.9 cts. per sq. ft.

Independence, Mo.—It is stated that bids will be received until May 25 by the City Council for grading portions of several streets and paving a portion of E. Pacific St. with vitrified brick. H. H. Pendleton, City Engr.

Jersey City, N. J.—The repaving of a portion of Newark Ave. with granite block or asphalt is reported under consideration.

Brooklyn, N. Y.—Bids will be received until June 1 by the Comrs. of Parks (John J. Pallas, Pres.), N. Y. City, for furnishing material and laying cement sidewalks on streets adjacent to and around several parks in the Boro. of Brooklyn.

New Brighton, S. I., N. Y.—Bids will be received May 23 by Geo. Cromwell, Pres. Boro. Richmond, for furnishing materials and repaving a portion of Post Ave. Engineer's estimate: 8,200 sq. yds. asphalt block; 1,200 cu. yds. concrete, 3,700 lin. ft. new curb., 16 x 5 in., etc.; also for repaving portions of the gutters of Bard and Davis Aves. Engineer's estimate: 6,030 sq. yds. asphalt block; 240 sq. yds. Belgian block; 1,340 cu. yds. concrete, 4,670 lin. ft. 16 x 4 in. curb. and 6,950 lin. ft. old curb., rejointed and reset.

**Binghamton, N. Y.*—C. T. Willard, of New York City, is stated to have received the contract for furnishing 50,000 brick for resurfacing the asphalt pavement on Chenango St., at $11.90 per M.

Elmira, N. Y.—Bids will be received until June 1 by the Bd. Pub. Wks. for paving a portion of W. Clinton St., as advertised in The Engineering Record.

Syracuse, N. Y.—It is stated that bids will be received until May 23 for paving with either brick or asphalt on Pearl, Fallman and Catherine Sts. F. J. Schnauber, City Engr.

Rochester, N. Y.—The Common Council is stated to have passed ordinances providing for improvement of the following streets: Melville, Goodman, Grove, O'Neil and Alexander Sts., also for Linwood Pl., East and Hudson Aves.

**Albany, N. Y.*—Robt. Shafer of Albany is stated to have received the contract for paving about 5,780 sq. yds. on Hudson Ave. (bids opened May 1) for $25,564.

Oxford, N. Y.—Bids are wanted June 1 for macadamizing in this village, as advertised in The Engineering Record.

Henderson, N. C.—The citizens are stated to have voted to issue $20,000 bonds for improving Vance County roads.

Cleveland, O.—Bids will be received May 30 by the Bd. Pub. Service (A. R. Callow, Secy.), for furnishing materials and laying about 2,600 sq. yds. macadam on drives in Edgewater Parkway.

Mansfield, O.—Bids will be received until June 7 by D. S. Koontz, City Aud., for $22,400 street and sidewalk improvement bonds.

Warren, O.—It is stated that bids will be received until May 23 by the Co. Roads Comrs. of Dist No. 1 (C. C. Chryst, Secy.), for constructing about 13 miles of turnpike roads. H. C. White, Co. Engr.

East Cleveland, O.—It is stated that bids will be received until June 7 by the Bd. Educ. (H. F. Jordan, Clk.), for grading lot, and constructing sidewalks and driveway for new Shaw High School.

West Carrollton, O.—It is stated that bids will be received by the Village Council until May 29 for grading and graveling 4 streets. John B. McNab, Village Clk.

**Cincinnati, O.*—The contract for improving a portion of Washington Ave. by grading, curbing and paving with bitulithic (bids opened May 10) has been awarded to Warren Bros. Co., Mercantile Library Bldg., for $24,529.

Bids will be received June 8 by the Bd. Pub. Service (Geo. F. Holmes, Clk.) for furnishing materials and grading, curbing and paving with brick a portion of Conroy St., and a portion of Ringgold St. with bitulithic pavement.

Bids will be received by the Bd. Co. Comrs. until June 16 for improving a portion of Fleming Road in Springfield Township.

Cincinnati, O.—Maj. Saml. Whinnery is reported to have been selected to prepare plans for constructing and maintaining a Municipal asphalt plant for street repairs.

Council is stated to have passed resolutions providing for the paving with bitulithic paving on portions of Betts, Poplar, Clinton and Windsor Sts., also with granite on Butler St.

Newark, O.—Bids will be received until May 26 by the Bd. Pub. Service, (Frank F. Maurath Clk.) for furnishing materials and paving a portion of Woods Ave., requiring 2,853 sq. yds., brick or sheet asphalt pavt., 1,655 lin. ft. sand-stone or artificial stone curbing and 118 lin. ft. edging.

Wyoming, O.—Bids will be received until June 10 by the Village Council (W. A. Clark, Clk.) for grading and laying cement sidewalks on portions of Barney, Grove and Springfield Aves.

Mansfield, O.—Bids will be received by the Bd. Pub. Service until June 1, for furnishing material and improving portions of several streets, requiring 5,910 sq. yds. vitrified brick, 3,060 sq. yds. cement or flagstone sidewalks, 11,270 cu. yds. grading, 2,040 lin. ft. curb, etc.

**Harrisburg, Pa.*—The Barber Asphalt Paving Co. is stated to have received the contract for paving with sheet asphalt portions o fFront St. and Haehnlen Ave. at $1.57 and $1.71 per sq. yd. respectively.

**Erie, Pa.*—Mayer Bros., 1213 State St., are stated to have received contracts for paving portions of *a* 6th St. and *b* 9th St. as follows: Asphalt per sq. yd. *a* $1.245, *b* $1.24 per sq. yd.; stone curbing *a*, 50 cts., *b*, 49 cts.; catch basins *a* and *b*, $29; landmarks *a* and *b*, $5; 9 in. pipe *a*, 50 cts.; *b*, 49 cts.

York, Pa.—The Highway Com. of Councils awarded contract May 11 to Barber Asphalt Co., of Philadelphia, on N. George St., for $1.35 sq. yd., and S. Beaver St. and W. York Ave., $1.54½ per sq. yd.

Freeport, Pa.—Bids will be received until May 25 by the Burgess and Council for paving with brick, about 9,000 sq. yds., as advertised in The Engineering Record.

Wilkesbarre, Pa.—It is stated that bids will be received until June 6 by Jas. M. Norris, Co. Compt., for constructing about 40 steel and stone arches in Luzerne County, the cost ranging from $250 to $2,000 each. W. B. Singrey, Co. Aud.

Memphis, Tenn.—See "Miscellaneous."

Petersburg, Va.—See "Water."

Seattle, Wash.—See "Water."

**Tacoma, Wash.*—The contract for paving with asphalt a portion of North K St. is stated to have been awarded to the Barber Asphalt Paving Co. for $36,880.

Seattle, Wash.—The contract for paving with asphalt 18th Ave., and other streets (bids opened Apr. 29), has been awarded to Stirrot & Goetz, 406 Washington Blk., for $379,852. For detail bids received for this work see issue of The Engineering Record May 13.

Ordinances have been passed by Council providing for grading on Ross Pl., Louisa St., Fremont Ave. and other streets at a cost of $51,200; concrete walks on Northlake and Linden Aves. and other streets, $59,300; asphalt paving on Aloha St., $4,600, and sewers on 10th Ave., N. E., $4,300.

**Bellingham, Wash.*—The contract for paving with asphalt on Elk St. is stated to have been awarded to Stirrat & Goetz, Washington Bldg., Seattle, for $22,946.

Antigo, Wis.—It is stated that bids will be received until June 5 by V. P. Bath, Co. Aud., for constructing 20,000 sq. ft. cement sidewalks.

Brantford, Ont.—It is stated that bids will be received until May 25 by R. W. Robertson, Chmn. Bd. Pub. Wks. for constructing 50,000 sq. ft. of concrete sidewalks. T. Harry Jones, City Engr.

POWER PLANTS. GAS AND ELECTRICITY.

Notes Arranged Alphabetically by States.

Ventura, Cal.—Bids are about to be asked for the purchase of $125,000 bonds to be used for the construction of water-works and an electric light plant, and $10,000 for a storm sewer on Ash St.

Visalia, Cal.—It is stated that bids will be received until June 5 for an electric franchise in the city. Eugene L. Scott, Co. Clk.

Washington, D. C.—The time for receiving bids for constructing and installing heating, lighting, power plant, and water supply for the Industrial Home School at Blue Plains, D. C., has been extended by the Comrs. D. C., from May 31 to June 10, as advertised in The Engineering Record.

Jackson, Ga.—J. B. McCrary, of Senoia, has been selected to prepare plans for water works and an electric light plant.

Pelham, Ga.—W. H. Maury, of the Pelham Electric Light Co., writes that he will receive bids at once for an electric light plant to cost $12,000.

Paris, Ill.—The Council is reported to have authorized the Electric Light Comrs. to secure estimates on doubling the capacity of the electric light plant.

Alexandria, Ind.—The Alexandria Electric Light & Power Co. is reported to have decided to install a new system and add 25 arc lamps to the city lighting system.

Perry, Ia.—The citizens are reported to have voted to grant Kinkead & Mentzer, of Knoxville, a franchise for a gas plant.

Sioux City, Ia.—The Sioux City Gas & Electric Co. will expend about $100,000 in improvements.

Newport, Ky.—Bids will be received by the General Council of the city, on June 8, for the exclusive franchise to lay, maintain and operate gas pipes, etc., as advertised in The Engineering Record.

**Hagerstown, Md.*—The Buckeye Engine Co., Salem, O., is stated to have secured the contract for a 500-hp. engine for the municipal electric light plant for $7,285, and the Westinghouse Electric Co., of Pittsburg, Pa., the contract for a generator for $5,750.

Framingham, Mass.—The Bd. of Selectmen is stated to have been authorized to appoint a committee to consider the purchase or construction of a plant for the manufacture and distribution of gas.

Marine City, Mich.—C. H. Lord, of the St. Clair River Gas Co., writes that it is proposed to construct a gas plant here.

Detroit, Mich.—The Detroit City Gas Co. is reported to have decided to expend $100,000 in improvements.

Sault Ste. Marie, Mich.—The Edison Sault Electric Co. is reported to have filed a mortgage for $500,000, the proceeds to be used in extending the power plant. The first section of the new plant will develop between 2,500 and 3,000 h.p.

Menominee, Mich.—Wm. Holmes, of Menominee, writes that it is proposed to develop the water power of Menominee River, at a probable cost of $250,000, but nothing definite has yet been done. Engineer, N. M. Edwards, of Appleton.

Rothsay, Minn.—The Rothsay Lighting & Heating Co. is stated to have secured a franchise for a gas plant.

Owensboro, Ky.—The Owensboro Gas Light Co. (C. F. Hoppe, Supt.), is stated to have applied to City Council for new franchise, and if granted the company will expend $150,000 on a new system.

Aitkin, Minn.—It is stated that the Aitkin Power & Light Co. will construct a water power plant at a cost of $20,000.

Sanborn, Minn.—Bids will be received until May 29 by the Village Council for $6,000 bonds for establishing a lighting plant; Geo. Posy, Village Recorder.

Alma, Neb.—Bids will be received by the City Clk. until June 8 for furnishing material and constructing an electric light plant and water works system, consistingg of approximately a 10-in. tubular well, power house machinery setting, etc.; two 60-in. x 14-ft. return flue tubular boilers and one 150-h.p. heater, one 60-h.p. high speed engine, a 40-kw. d c. dynamo and fixtures, poles, wire, lamps, etc., a simple, duplex steam fire pump, a boiler feed pump and a deep well power pump, about 1½ miles of water pipe with hydrants, valves, etc., a stand pipe or elevated steel tank and tower; also gas producer plant. M. A. Earl, Con. Engr., 1416 First Natl. Bank Bldg., Chicago, Ill.

Trenton, N. J.—The National Light & Improvement Co. is reported incorporated with a capital of $2,000,000 to contract to supply cities with gas and electric lights. Incorporators: H. C. Scott, of St. Louis, Mo., and L. B. Dailey and Thos. F. Barrett, both of Jersey City.

New York, N. Y.—Plans have been filed for a 3-story power station to be constructed by the New York Edison Co. on 1st Ave. and 39th St. It will cost about $1,500,000.

The Aqua Light & Power Co. of New York City has been incorporated; capital, $100,000. Directors: Daniel H. Foley of Brooklyn, Jos. M. Linden of Woodridge and Jas. Simons of New York.

**The Commercial Constr. Co., 1 Madison Ave., has secured the contract for installing electric equipment in School No. 85, Manhattan Boro. (bids opened May 15) for $5,937.

New York, N. Y.—Bids will be received until May 31 by John F. Ahearn, Boro. Pres., for completing the electrical wiring system in the Criminal Court Bldg., Boro. Manhattan.

Hempstead, L. I., N. Y.—The Nassau & Suffolk Lighting Co., of Hempstead, has been incorporated to operate in Nassau and Suffolk Counties; capital, $200,000. Directors: Samuel M. Havens and F. C. Hauser of N. Y. City, and Jas. G. Stevenson of Brooklyn.

Syracuse, N. Y.—The Oswego River Power Transmission Co., of Syracuse, has been incorporated, to supply gas and electricity for power, light and heat in the counties of Onondaga and Oswego in particular, with the privilege of operating all through the State; capital, $20,000. Directors: Simon B. Storer, Louis W. Emerich and Geo. W. Pulver, of Syracuse.

Sandy Hill, N. Y.—The Glens Falls Electric Light Co., of Glens Falls, is stated to have secured a 50-

**Items marked thus give the names of parties awarded contracts.*

yr. franchise to operate in Sandy Hill. The company will furnish incandescent lights for 10 cts. per kw. hour and supply current for manufacturing purposes at 5 cts. per kw. hour, arc lights to be $70 per lamp per yr. for 2,000 c.p.

Niagara Falls, N. Y.—The Electric Power & Transmission Co., of Niagara County, is reported incorporated, with a capital of $5,000,000 to supply light, heat and power in all counties between Niagara and Albany, including Saratoga, Rensselaer and Schenectady. Incorporators: Edw. B. Bruce and Frank H. Cole, of New York, and John J. Daly, of Brooklyn.

Troy, N. Y.—The Troy Public Service Co., of Troy, has been incorporated, to operate in Rensselaer and Albany Counties; capital, $100,000. Directors: Michael F. O'Connor, Chas. S. Aldrich and Edw. Murphy, 2d, of Troy.

Fulton, N. Y.—The Overland Power Co. has been incorporated; capital, $20,000. Directors, Simon B. Storer and Geo. W. Pulver, of Syracuse, and Louis W. Emerich of Fulton.

Holley, N. Y.—The Village Trus. are stated to have granted the Niagara Falls Electric Transmission Co. a franchise to erect poles and construct lines in the village for electric light, heat and power purposes.

Wilmington, N. C.—Bids will be received until June 8 by A. M. Waddell, Mayor, for lighting the city with gas and electricity.

Buffalo, N. Y.—The Niagara Falls Electrical Transmission Co. is stated to have petitioned the Bd. of Aldermen for a franchise.

The Western Counties Transmission Co. of Buffalo has been incorporated; capital, $2,000,000. Directors: Robt. W. Pomeroy, Jos. G. Dudley, Harry T. Ramsdell and others. This company is to cover the counties of Erie, Niagara, Chautauqua, Cattaraugus, Genesee, Orleans, Wyoming, Allegheny, Monroe, Livingston, Ontario, Wayne, Yates, Schuyler, Chemung, Cayuga, Tompkins, Tioga, Oswego, Seneca, Onondaga, Cortland, Broome, Oneida, Madison, Chenango and Herkimer.

North Tonawanda, N. Y.—It is stated that bids will be received until June 6 by Geo. J. Smith, City Clk., for lighting the city for a period of 1 or 3 years from Aug. 1, 1905.

Hoosick Falls, N. Y.—The Hoosick Falls Illuminating Co., of Hoosick Falls, has been incorporated with a capital of $150,000. Directors: Roger Lewis and Ralph W. Gifford, of New York and others.

Chatham, N. Y.—The Lindenwald Light, Heat & Power Co., of Chatham, has beeen incorporated; capital, $25,000,000, to operate in Columbia County and the City of Hudson.

Utica, N. Y.—The Central New York Power Co., Utica, has been incorporated; capital, $1,000,000. Directors: Wm. E. Lewis, Utica; Harry Patton, Whitesboro, and others.

Blasdell, N. Y.—The Blasdell Electric Company, of Blasdell, has been incorporatted; capital, $50,000. J. B. Wall, of Buffalo, is one of the incorporators.

Cazenovia, N. Y.—The Cazenovia Electric Co., Cazenovia, has been incorporated; capital, $30,000. Incorporators: R. F. Hubbard, of Cazenovia; R. S. Brewster, of New York, and others.

Camden, N. Y.—Earl W. Vandawalker is reported to be president of new electric lighting commission, and it is stated that steps will be taken at once to install the plant.

Morehead City, N. C.—It is reported that the question of installing an electric light plant in connection with a water supply for fire protection is under consideration.

**Springfield, O.*—A. J. Stahl, of Laporte, Ind., is stated to have secured the contract for constructing new heating works and system for the People's Light, Heat & Power Co., which is to cost about $200,000.

Wasco, Ore.—W. M. Barnett, of Wasco, Pres. and Mgr. Wasco Milling Co., writes that it is proposed to construct an electric light and power plant to cost from $35,000 to $40,000. Engineer, A. M. Mohr, The Dalles. The plant will be located about 13 miles east of Wasco on John Day River.

Prairie Grove, Ore.—C. L. Cummings & Son are ready to receive bids for the construction of an electric light plant to cost from $2,000 to $3,000.

Selingsgrove, Pa.—Bids will be received June 1 by Geo. W. Agenseller, Secy., Middlecreek Electric Co., Middleburg, for constructing a complete water power electric plant, on Middlecreek, two miles south of Selingsgrove, for supplying light, heat and power to Selingsgrove, Sunbury, Northumberland, and perhaps to Middleburg, to consist of a dam across a ravine, about 360 ft.; spillway of dam to be 150 ft. long, dam to be 17 ft. high above water as per print a tunnel and excavation 1,255 ft. long through mountain for head race; 2 units consisting of 4 wheels, direct connected to 2 generators, switchboard, power house and 25 or 30 miles of line construction.

Wilkesbarre, Pa.—The directors of the Wyoming Valley Gas & Electric Co., at a meeting here May 11 approved of work already under way, also recommended an additional expenditure for equipment of power houses and for other machinery. They authorized an expenditure of $75,000 for new gas making machinery and laying new pipe. Ambrose West, of Plymouth; C. H. Geist, of Philadelphia, and W. H. Anderson, of Grand Rapids, Mich., are reported to be among the directors.

**Philadelphia, Pa.*—The Horn & Brannen Mfg. Co. is stated to have secured the contract for installing gas and electric light fixtures in the Northeast Manual School for $9,950.

Kennett Square, Pa.—Bids will be received May 25 by the Boro. Council (W. C. Voorhees, Secy.), for lighting the streets, hall and fire engine house in this Boro.; information can be secured by addressing C. J. Pennock, Chmn., Light Com.

**Pittsburg, Pa.*—Maj. Wm. L. Sibert, Corps Engrs., U. S. A., writes that the lowest bid opened on May 12 for building a power house at each of Dams Nos. 3, 4 and 5, Ohio River, was submitted by the Brady Constr. Co., of Fairmont, W. Va., at $12,879, for each house.

Columbia, S. C.—The Columbia Electric St. Ry. Light & Power Co. is stated to have decided to acquire by purchase the plant of the Columbia Water Power Co. It is proposed to construct a steam turbine auxiliary power plant, at a cost of about $300,000. Edwin W. Robertson, of Columbia, will probably be president.

Deadwood, S. D.—The Lead and Deadwood Electric Light Companies are reported to have been consolidated and will expend about $1,000,000 in the installation of new machinery and building transmission lines; a power plant will also be constructed at Pluma. N. E. Franklin, of Deadwood, is reported interested.

Memphis, Tenn.—A committee is stated to have been appointed by Mayor Williams to secure information as to cost, etc., of an electric light plant, to be owned and operated by the city at a probable cost of $1,000,000.

Ephraim, Utah.—Jas. Frost, City Recorder, writes that the citizens have voted to construct an electric light plant, at a cost of $20,000.

Coalville, Utah.—An election will probably soon be held to vote on issuing $10,000 bonds for the construction of an electric light plant.

Norfolk, Va.—Bids will be received until June 10 by Mordecai T. Endicott, Ch. Bureau of Yards and Docks, Navy Dept., Washington, D. C., for installing a 15-ton electric traveling crane in Bldg. No. 37, Navy Yard, Norfolk.

Richmond, Va.—E. W. Trafford, recently appointed by the city to report on the matter of a municipal electric light plant, is stated to have completed his report and estimates the cost of a plant at $400,000. Mr. Dabney, Chmn. Lighting Com.

Seattle, Wash.—The Seattle Electric Co. is reported to be considering the extension of its system to the northeastern part of city.

Wauwatosa, Wis.—The Co. Bd. of Superv., at a meeting at Milwaukee, May 9, is stated to have passed a resolution providing for the appropriation of $100 to be used to prepare plans for the installation of a general light and heating plant and a pumping station for the county institutions at Wauwatosa.

Dauphin, Man.—The Town Secy.-Treas. writes it is proposed to construct an electric light plant at a cost of $25,000.

Winnipeg, Man.—Bids will be received by J. W. Cockburn, Chmn. Special Power Com., June 12, for the supply of electric power, as advertised in The Engineering Record, the power to be delivered to the city at a point to be agreed upon, east of Main St., to be paid for monthly, the quantity used to be determined by Watt meters, placed on city's incoming switchboard. The maximum quantity of power to be used at any time will be 1,500 h.p.

**Niagara Falls, Ont.*—The Archbold Brady Co., of Syracuse, N. Y., is stated to have secured the contract for the construction of steel towers for the double transmission line from Niagara Falls, a distance of about six miles; contract price reported to be $50,000.

ELECTRIC RAILWAYS.

Notes Arranged Alphabetically by States.

Birmingham, Ala.—W. H. Woodford, Rufus N. Rhodes, E. W. Rucker, are stated to have under consideration the construction of an electric railway in Birmingham.

Hollister, Cal.—It is reported that J. C. Kemp has applied to the Bd. of Superv. for a franchise to construct an electric railway along certain country roads, and that bids for said franchise will be received by the Bd. until June 24. Elmer Dowdy, Co. Clk.

Benicia, Cal.—The construction of an electric railway between the San Ramon Valley and Oakland is reported under consideration. Frank Gavin, of Concord, is reported interested.

Chicago, Ill.—It is stated that the Chicago & Milwaukee Electric R. R. Co. will build a line from Rockefeller, near Waukegan, Wauconda, McHenry, Woodstock and Belvidere, there to connect with the Rockford & Interurban Co.

Ft. Wayne, Ind.—It is stated that the Ft. Wayne & Wabash Valley Co. has decided to build immediately from Ft. Wayne to Marion via Bluffton, and that the right of way has been secured. Contracts for grading and material will be let at once for 50 miles of road.

Des Moines, Ia.—S. A. Park, of Chicago, Ill., is stated to have in contemplation the construction of an electric railway between Des Moines and Creston.

Hopkinsville, Ky.—The construction of an electric railway from Evansville, Ind., to Bowling Green, Ky., through Henderson, Hopkinsville and Russellville is reported under consideration. Harris F. Holland, Pres., of the Holland Palace Car Co., of Indianapolis, Ind., is reported interested.

New Orleans, La.—The charter of the Gulfport & Mississippi Traction Co., with a capital of $1,000,000 has been approved by Gov. Vardaman. Incorporators are: J. T. Jones, W. A. White, E. J. Bowers, W. K. Dukate and others.

St. Paul, Minn.—The Council is stated to have granted a franchise to the Twin City Co. to build its line to South St. Paul.

Hattiesburg, Miss.—The Hattiesburg Traction, Light & Power Co., capital $250,000, is reported organized. H. A. Camp, Lumberton, Pres.; H. L. McKee, Meridian, Gen. Mgr.; A. F. Thomasson, Hattiesburg, Secy. and Treas.

Kansas City, Mo.—It is reported that the Metropolitan St. Ry. Co., of Kansas City, is having surveys made for a line from Leavenworth to St. Joseph.

Morristown, N. J.—The Morris County Traction Co. is stated to have decided to construct an electric railway through Summit.

Auburn, N. Y.—The Auburn & Northern R. R. Co. is stated to have secured a franchise to construct its line in State St. to the northern boundary of the city. It is reported that the company will construct the road to Port Byron.

Catskill, N. Y.—The Catskill Electric Ry. Co. is stated to have filed with the Secretary of State a certificate to extend its lines in Catskill.

**Steubenville, O.*—The Steubenville & Wellsburg Traction Co. is stated to have awarded the contract to T. J. Stringer, of Portland, for grading 10 miles of road.

Uhrichsville, O.—The Uhrichsville & New Comerstown Ry. Co. is reported formed with a capital of $10,000 to build a 15-mile electric railway from Uhrichsville to New Comerstown. T. D. Healean, G. S. Evans and others of Uhrichsville are reported interested.

Norwalk, O.—It is stated that the Mansfield, Greenwich & Norwalk Ry. Co. has practically all of the right of way secured for the railway and that the line will be built this summer.

Portsmouth, O.—J. N. Gardner and T. R. Smith, of New York, and Geo. W. Nicholls, of Cincinnati, are reported to be preparing plans for the extension of the Cincinnati, Georgetown & Portsmouth Ry. from West Union to Portsmouth.

Cleveland, O.—The project of building a road down the Cuyahoga Valley to Akron is stated to have been revived. All right of way was secured and much grading was done about 2 years ago. H. C. Wheeler, one of the promoters, says that the project will be taken up at once.

Martin's Ferry, O.—The Wheeling Traction Co. is reported to have decided to construct an extension north to Brilliant.

Zanesville, O.—The Muskingum, Coshocton & Tuscarawas Ry. Co. is stated to have secured a franchise to cross country roads and to use a county bridge for its proposed line from Zanesville to New Philadelphia.

Canton, O.—It is reported that the Canton & Steubenville Traction Co. contemplates constructing a line from Canton to Steubenville. The road will be 65 miles long. T. H. Loomis and Ira Blackburn of Steubenville are reported interested.

Cincinnati, O.—It is stated that the Cincinnati, Toledo & Detroit Short Line Ry. Co. contemplates constructing a line from Cincinnati to Toledo. J. Morgan, Pres.

Harrisburg, Pa.—A. J. Barron, of Pittsburg, is president of three street railway companies which have received charters at the State Department to operate in Allegheny County as follows: The Carnegie & Rennerdale Co. to construct a line 4 miles in length from Carnegie to Rennerdale, capital $24.000. The Oakdale & McDonald St. Ry. Co., with $21,000 capital, to build 3½ miles of road around Oakdale, and the Rennerdale & Oakdale St. Ry. Co. to operate 3 miles of road between Rennerdale and Oakdale.

Philadelphia, Pa.—See "Railroads."

Providence, R. I.—The construction of an electric railway from Watch Hill to Narragansett Pier is reported under consideration. A. B. Crafts is stated to be interested in the project.

Gallatin, Tenn.—Chas. A. Whiteside, Pres.; H. C. Rutledge, Treas.; E. O. Buchanan, Secy., are reported to be the officers of a company that proposes constructing an electric railway from Gallatin to the Cumberland River, 3 miles from town.

Gainesville, Tex.—The Gainesville Electric Ry. & Light Co. is reported in corporated with a capital of $50,000. Incorporators are: Edward J. O'Bierne, of Memphis, Tenn.; Chas. A. Zilker, of San Antonio; Wm. K. Greenville and Wm. H. O'Bierne, of Gainesville.

Charlotte Court House, Va.—The Appomatox & Charlotte Ry. Co. is reported incorporated by B. P. Eggleston, Pres., Drake's Branch; S. L. Ferguson, Secy., West Appomattox, to construct, operate and maintain a railway from Appomattox to Drake's Branch, Va. Capital $5,000.

Fairmont, W. Va.—The Fairmont & Clarksburg Traction Co. is reported to be securing right of way for the street car line through the Bellview addition.

Montreal, Que.—The question of operating the Tomiscaming & Northern Ry. from North Bay to New Liskiard by electricity is reported under consideration.

RAILROADS.

Notes Arranged Alphabetically by States.

Colorado Springs, Colo.—The Southern Development Co. is reported incorporated for the construction and maintenance of railroad, telephone and telegraph lines, electric light plants, water works, tramway systems and other utilities and for the development of lead, iron, coal, placer, gold, silver and copper mines in Arkansas and Louisiana. Principal office of the company will be in Colorado Springs. Wm. A. Otis, a banker, of Colorado Springs, is Pres.

Tishomingo, Ind. Ter.—The business men of this place are reported to have decided to petition the missouri, Oklahoma & Gulf R. R. Co. to extend its lines to Tishomingo, a distance of about 75 miles. (G. F. Morse, Ch. Engr., Kansas City, Mo.)

Indianapolis, Ind.—The Bd. of Works is stated to have adopted a resolution ordering the railroad tracks elevated at the West St. Kentucky Ave. and Louisiana St. grade crossings. B. J. T. Jeup, City Engr., estimates the cost of the work at $350,000.

Pineville, La.—The Louisiana Ry. & Navigation Co. is reported to have decided to construct a railroad from Pineville to Jena, a distance of about 30 miles. W. F. Taylor, vice-pres., Shreveport.

Jackson, Miss.—See "New Industrial Plants."

Marquette, Mich.—The Marquette & Southeastern Ry. Co. is stated to have decided to construct a branch line from Marquette to Lake Independence. (R. C. Young, Ch. Engr., Marquette.)

Binghamton, N. Y.—Improvements are reported to under consideration by the Delaware & Hudson R. R. Co. (Jas. MacMartin, Ch. Engr., Albany) involving the double tracking of the road between Binghamton, Nineveh and Carbondale and four-tracking the division between Scranton and Wilkesbarre.

Gypsum, O.—The Culver & Port Clinton R. R. Co., of Gypsum, has been incorporated to build a steam road from Gypsum to East Toledo, with branch to Bowling Green; G. A. Esch, Wart Beman and J. M. McNaught are the incorporators. Capital, $10,000.

Columbus, O.—The Pittsburg, Cincinnati, Chicago & St. Louis Ry Co. (Thos. Rodd, Ch. Engr., Pittsburg, Pa.), is reported to have decided to expend about $1,500,000 in improvements between Pittsburg and Columbus.

Philadelphia, Pa.—The Philadelphia & Western R. R. Co. is reported to have passed into the hands of financial interests represented by E. W. Clark & Co., bankers, at 139 S. 4th St. It is the intention of the promoters to push it to completion as fast as possible. The road is to be operated by electricity and a meeting was held re-

**Items marked thus give the names of parties awarded contracts.*

cently to consider the purchase of the necessary electrical equipment. E. A. Van Brunt, of New York, Pres.; John M. Bramlette, Philadelphia, Gen. Mgr. It was announced that the road would be double-tracked between 63d and Market Sts. and Wayne, a distance of 12 miles. A power plant will be erected in the neighborhood of Cobb's Creek, and power for the line's operation will be generated from that point.

Harriman, Tenn.—The Tennessee & Atlantic Ry. Co. is reported incorporated with a capital of $50,000 by E. C. Meyers, S. H. Parks, H. M. Carr and others, to construct a railroad from Harriman to the Tennessee and Georgia state line at a point between Blue Springs and Blue Mountain. It will connect with the Southern, Cincinnati Southern, Tennessee Central and Harriman and Northeastern Railroads.

**Norfolk, Va.*—Oliver & Sands, of Roanoke, are stated to have secured the contract for the construction of the first 100 miles of the Tidewater Ry., which is planned to be built from the sea to the southwest coal fields, starting at Norfolk.

**Owen, Wis.*—McIntosh Bros., of Milwaukee, are reported to have secured the contract from the Owen & Northern Ry. Co. for the construction of a line from Owen, on the Wisconsin Central R. R., to Ladysmith, a distance of 50 miles.

Ottawa, Ont.—The bill to incorporate the Algoma Copper Range Ry. Co. was reported before the Senate Ry. Com. at Ottawa on May 5. This road is to run from between Biscotasing and Cartier, on the C. P. R. main line, to Lake Superior, to develop copper properties and serve as a means of getting the ore out to the lake. A bill was also reported to incorporate the Montreal, Quebec & Southern Ry. Co., with a capital of $1,000,000.

PUBLIC BUILDINGS.

Notes Arranged Alphabetically by States.

**Prattville, Ala.*—M. T. Lewman, of Louisville, Ky., it is stated, has received the contract to erect the court house at $44,400, and Dobson & Bynum, of Montgomery, Ala., the contract for the jail at $18,000.

Montgomery, Ala.—Local press reports state that the Capitol Bldg. Comn. has decided to receive competitive plans until July 5 for the general enlargement and improvement of the Capitol and the erection of a wing on the south side, the total cost to be about $70,000.

Ft. Miley, Cal.—Bids will be received June 5 by Col. Wm. S. Patten, Ch. Q. M., U. S. A., San Francisco, for construction, plumbing and electric wiring of 1 double set of non-commissioned officers' quarters at Ft. Miley.

Colorado Springs, Colo.—Bids will be received by the Superv. Archt. Treas. Dept., Washington, D. C., June 20, for the construction of a U. S. Post-Office at Colorado Springs, as advertised in The Engineering Record.

Washington, D. C.—Bids will be received by Col. Chas. S. Bromwell, at the office of Pub. Bldgs. & Grounds, May 31, for furnishing and erecting 6 iron book-stacks in library hall, Army Medical Museum and Library, as advertised in The Engineering Record.

Bids will be received June 3 at the office of Bldg. for National Museum, Library of Congress, for furnishing and delivering red bricks, natural hydraulic cement, and sand for the new building for the National Museum in this city; Bernard R. Green, Supt. Constr.

Key West Barracks, Fla.—Bids will be received by the Quartermaster U. S. A., June 15, for constructing a boat house, also for furnishing new, and materials for repairs to old, door and window screens, both advertised in The Engineering Record.

**Ft. McPherson, Ga.*—Contracts for construction, etc., of buildings at this post (bids opened Apr. 25) are stated to have been awarded as follows: construction proper. Nicholas Ittner, 1015 Prudential Bld., Atlanta, $85,037; plumbing and heating, Newport Plumbing, Htg. & Tinning Co., Newport News, Va., $20,655, and wiring, etc., The Watson-Flagg Eng. Co., Empire Bldg., Atlanta, $1,749.

**Madison, Ga.*—The Winder Lumber Co., of Winder, Ga., it is reported, has received the contract to erect the court house at a cost of about $40,000.

Chicago, Ill.—Bids will be received until May 29 by the Dept. Pub. Wks. (Jos. M. Patterson, Comr.) for constructing and erecting steel trusses, concrete roof, skylight, sheet metal work, etc., and rebuilding brick work for a new roof over the boiler room of the 14th St. Pumping Station; bids will also be received until June 1 for furnishing materials for excavation, masonry, cut stone, concrete floor, gravel roof, carpentry, steel and iron work, etc., for hydrant room addition to repair shop, Ashland Ave. and 22d St.

Ft. Sheridan, Ill.—Bids will be received until May 27 by Capt. Wm. Weigel, Constr. Q. M., Ft. Sheridan, for constructing additions to hospital at this post, including plumbing, gas piping and steam heating.

LeRoy, Ill.—It is reported that a library is to be erected at a cost of $50,000.

Clinton, Ill.—It is stated that plans are being prepared for a hospital which is to be erected at a cost of $35,000.

Lawrence, Ind.—Bids will be received until June 14 by Capt. B. F. Cheatham, Constr. Q. M., Lawrence, for furnishing material and constructing heating, plumbing and electric wiring 44 buildings, as advertised in The Engineering Record.

Marion, Ind.—It is stated that Geo. A. Schibeler is Secy. of the Comn. appointed by the Governor to select a site and erect the Southeastern Indiana Hospital for the Insane, for which $569,000 has been appropriated.

Indianapolis, Ind.—It is stated that plans are being prepared for the erection of 44 buildings at Ft. Benj. Harrison.

Atlantic, Ia.—Bids will be received until June 19 by Jas. Knox Taylor, Supervising Archt., Treas. Dept., Washington, D. C., for constructing complete the U. S. Post-Office at Atlantic.

Frankfort, Ky.—Bids will be received until May 25 by the State Capitol Comn. (Henry B. Ware, Secy.), for the excavation for the new capitol; F. M. Andrews, Archt., Dayton, O.

Springfield, Mass.—The Co. Comrs., it is stated, have secured a site on W. State St. on which it is proposed erecting a heating plant to furnish heat to both the court house and the new hall of records.

Malden, Mass.—The Com. on Pub. Property, it is stated, has reported in favor of erecting an armory for Company L, 5th Regt., at a cost of $40,000.

Boston, Mass.—Nashawena, the Buzzards Bay Island forming part of the town of Gosnold, it is stated, is to be the site for the new State Prison, which it is proposed erecting at a cost of about $800,000.

Fall River, Mass.—The following are reported to be the bids received for (*a*) recoppering or (*b*) slating the roof of the county court house here: William Kennedy, Fall River, *b* $11,500, *a* $13,000; S. D. Hicks & Son, Boston, *a* $9,957, *b* $11,384; Fall River Metal & Cornice Wks., *a* $9,975.

Watervalley, Miss.—Bids will be received July 3 by the Bd. Co. Superv., (J. Leland, Clk.) for $15,000 jail bonds.

Gulfport, Miss.—The City Council has engaged H. C. Black to prepare plans and supervise the construction of the city hall, which it is proposed erecting at a cost of $20,000.

**Farmington, Mo.*—M. G. Gresham, Secy. Bd. Mgrs. State Hospital, writes that the contract for ventilating and heating apparatus in hospital (bids opened May 8) has been awarded to Louis & Kitchen, Kansas City, for $4,634.

Nevada, Mo.—It is reported that bids will be received until June 2 by the Bd. Trus. (John Montgomery, Pres.) for erecting State Hospital No. 3.

Columbia, Mo.—The following are the bids opened by the Superv. Archt., Treas. Dept., Washington, D. C., recently received for the construction complete of U. S. Post-Office at Columbia: Paducah Constr. Co., Paducah, Ky., $29,750; Dieter & Wenzel, Joplin, $28,754; English Bros., Champaign, Ill., $27,789, and Latimer & Bennings, Kansas City, $27,638.

Lincoln, Neb.—Bids will be received until June 1 by A. Galusha, Secy. of Bd., at Lincoln, for erecting a hospital and barn at the Soldiers and Sailors' Home at Grand Island; also for rebuilding asylum and new wing at Norfolk; cost of said buildings not to exceed $20,000, and for new buildings at Beatrice.

**Seward, Neb.*—L. W. Pomerene & Co., of Lincoln, it is stated, have received the contract for the plumbing in the court house at $6,100.

Nashua, N. H.—It is stated that the Council has decided to select the Main St. school site for the proposed library. By the will of the late Daniel Huzzey, $50,000 was left for the erection and maintenance of a library.

Union, N. J.—Archt. Albert R. Ross, 542 5th Ave., New York, N. Y., writes that bids will be opened June 8 for a public library for Union, to cost about $25,000.

Ft. Mott, N. J.—Bids will be received by Capt. Louis F. Garrard, Jr., Q. M., U. S. A., at Delaware City, Del., on May 31, for removing 11 frame buildings to sites indicated, and raising one building on present site, as advertised in The Engineering Record.

Ft. Hancock, N. J.—Bids will be received until June 16 by Comdg. Officer Sandy Hook Proving Ground, P. O. Ft. Hancock, for erecting a brick building for housing 3 locomotives and one locomotive crane, also on same date for erecting an ordnance barracks, both proposals advertised in The Engineering Record.

New York, N. Y.—Bids will be received May 25 by Francis J. Lantry, Comr., Dept. of Correction, 148 E. 20th St., for furnishing materials and erecting a kitchen and laundry building on Hart's Island, New York.

Bids will be received May 31 by Alfred Brooks Fry, Ch. Engr. and Supt. U. S. Pub. Bldgs., New York City, for furnishing materials required for restoration and general repairs to roofs, metal cornices, roof trim, etc., of the Court House and Post Office.

Plans have been filed for a 4-story brick training school for nurses to be erected at Cauldwell and Webster Aves., for Lebanon Hospital, at a cost of $50,000. Albert E. Davis, Archt., 494 E. 138th St.

**New Brighton, S. I., N. Y.*—Geo. Cromwell, Pres. Richmond Boro., writes that contracts for interior work in the borough hall (bids opened Apr. 18) have been awarded as follows: For erection and completion of certain finish and for partitions, screens, cages, etc., to Louis Wechsler, St. James Bldg., N. Y. City; for vacuum sweeping plant to Sanitary Compressed Air Vacuum Co., Fuller Bldg., N. Y. City, and for the installation and equipment of vaults and safe deposit to Art Metal Constr. Co., New York Life Bldg., N. Y. City.

Buffalo, N. Y.—Bids will be received until May 23 by Alonzo G. Hinkley, Clk. Bd. Superv. for constructing cement floors and steel tramway at the Erie Co. Hospital; also on same date for constructing a mortuary building, and for the installation of a patient elevator for the Erie Co. Almshouse and Hospital.

Newburg, N. Y.—The Bldg. Com. of the Bd. Superv., it is reported, is about to rebuild the court house at a cost of $40,000.

**Rochester, N. Y.*—T. E. McGarr, Secy., State Comn. in Lunacy, Albany, writes that contracts for work at the Rochester Hospital (bids opened Apr. 26) have been awarded as follows: To Barr & Creelman, of Rochester, for plumbing, heating and extension of bakery and laundry for $2,702, and to John C. Buchanan, of Syracuse, for installing new electric conduits, lighting and telephone cables and removing present pole lines, $1,180.

**West Point, N. Y.*—Lieut. Col. R. C. Foy, Acting Q. M., U. S. M. A., writes that the contract for the construction of 2 double and 4 triple sets of officers' quarters and for the erection of cadet barracks at West Point (bids opened Apr. 20), has been awarded to the Broderick & Wind Engr. & Constr. Co., 1 Madison Ave., N. Y. City, for $507,500 (omitting the north wing).

West Point, N. Y.—See "Miscellaneous."

Ft. Totten, Willets Point, N. Y.—Bids will be received by Capt. Geo. H. McManus, Constructing Q. M., U. S. A., June 8, for the construction, plumbing, etc., 3 double sets of captains' quarters, and one double set of lieutenants' quarters, as advertised in The Engineering Record.

White Plains, N. Y.—The Westchester Co. Bd. of Superv., it is reported, has decided to erect 2 additions to the present court house at a cost not to exceed $150,000.

Governor's Island, N. Y. H., N. Y.—Bids will be received by Capt. Traber Norman, Q. M., U. S. A., May 31, for constructing an addition to Chief Q. M. office, Bldg. No. 15, on Governor's Island, as advertised in The Engineering Record.

Utica, N. Y.—Fred. T. Proctor, Chmn. Bldg. Com. Oneida County Court House, writes that the date of opening of bids for erecting the court house has been extended from May 16 to May 26; cost reported to be about $1,000,000.

Winston, N. C.—Bids will be received by Jas. Knox Taylor, Superv. Archt., Treasury Dept., Washington, D. C., until June 21 for constructing (including plumbing, heating, electric wiring and conduits) the U. S. Post Office at Winston, N. C.

Fargo, N. D.—The Lutheran Hospital Assoc., it is stated, has been incorporated for the purpose of establishing a hospital for the care of the sick and infirm. Capital, $50,000. Rev. F. A. Fonkalsrud, of Fargo, is interested.

**Steubenville, O.*—A. W. McDonald & Co., of Steubenville, it is reported, have received the contract to erect the county infirmary (bids received May 9), at $91,167, including heating, plumbing and electric wiring.

Marion, O.—It is reported that bids will be received until May 23 by the Bd. Pub. Service (Wm. Fies, Clk.) for erecting a fire engine house. Wilbur T. Mills, Archt., Columbus.

Newark, O.—An ordinance has been adopted by the Council authorizing Solicitor Smythe to prepare an ordinance for the issuance and sale of $30,000 bonds to be used to erect a city hospital.

**Norwalk, O.*—F. O. Ronk, Deputy Co. Aud., writes that the contract for erecting an administration bldg. at the Huron Co. Infirmary Farm (bids opened May 10) has been awarded to G. M. Wood, of Norwalk, for $12,146.

Cleveland, O.—The Military Com. of the Chamber of Commerce, it is reported, has engaged Lehman & Schmitt, Garfield Bldg., to prepare plans for the completion of the Central armory at a cost of $50,000.

Bids will be received May 30 by the Bd. Pub. Service (A. R. Callow, Secy.) for furnishing materials and erecting a bath house on Market House grounds, Bway, including masonry, carpentry, painting, glazing, tile roofing, iron and steel, slate, lathing, plastering, tin work and the

Oklahoma, Okla. Ter.—Bids will be received until May 31 by Jas. Wilson, Secy., U. S. Dept. Agriculture, Washington, D. C., for erecting a 2-story and cellar brick building for the Weather Bureau, U. S. Dept. Agriculture, Oklahoma.

**Tilamook, Ore.*—G. B. Lamb, Co. Clk., writes that the contract for furnishing material and erecting a court house has been awarded to H. Snook, of Salem, for $19,500.

Ft. Mifflin, Pa.—Bids will be received June 7 by the Commandant, Navy Yard, League Island, Philadelphia, for erecting a magazine building, railroad tracks, poles and lighting conductors, at the Naval Magazine, Ft. Mifflin; plans and specifications may be secured from the Comdt. upon a deposit of $25. N. E. Mason, Ch. Bureau, Navy Dept.

Philadelphia, Pa.—Bids will be received May 29 by the Dept. Pub. Health and Charities (Edwd. Martin, Dir.) for furnishing and erecting fire escapes, steel plate flooring, etc., for the Philadelphia Hospital, 34th and Pine Sts.; plans and specifications may be obtained from the Archt., 1824 Land Title Bldg., upon a deposit of $50.

The Governor has approved a bill appropriating $250,000 for the erection of armories for the National Guard.

**A building permit has been granted to Henderson & Co., 1221 Arch St., to erect a 3-story granite and terra cotta fire house at 214 Pine St., to cost $20,000.

Watertown, S. D.—It is reported that bids will be received until June 1 by the Library Bd. (S. H. Goepfert, Chmn.) for erecting a Carnegie Library.

Lafayette, Tenn.—Bids will be received until May 29 by the Bldg. Com., Bd. Co. Comrs. (J. S. Wotten, Secy.) for erecting a brick jail and jailer's residence, with stone foundation, and furnished with 4 new cells and 1 old cell to be placed, and other necessary fixtures.

Appleton, Wis.—The plans of Van Ryn & De Gelecke, of Milwaukee, it is reported, have been accepted for the Carnegie library, which it is proposed erecting at a cost of about $50,000.

Buffalo, Wyo.—Bids will be received, June 5, by the State Bd. of Charities and Reform, Cheyenne (Thos. T. Tynan, Secy.) for furnishing material and erecting a boiler house and installing heating plant at the Wyoming Soldiers and Sailors' Home, Buffalo.

St. Boniface, Man.—Plans will be received until May 31 by Theo. Bertrand, Secy.-Treas. for a 3-story and basement city hall, to be constructed of brick and stone, 50 x 70 ft., and the estimated cost is not to exceed $40,000; also plans for a combined fire hall and police station which is to be erected on Tache Ave., Norwood, cost not to exceed $8,000.

BUSINESS BUILDINGS.

Notes Arranged Alphabetically by States.

Montgomery, Ala.—The Bonded Warehouse Co., it is stated, has been incorporated, with a capital of $200,000, with Wm. M. Marks as pres., for the purpose of erecting a bonded cotton warehouse. Jas. H. Hardaway is Secy.

Bisbee, Ariz.—It is reported that Boston & Brown intend erecting a building back of the Annex, to cost $18,000.

Hot Springs, Ark.—It is stated that bids will be received by F. J. Hart, archt., Arkansas Nat'l Bank Bldg., until about June 1 for erecting a 4-story and basement hotel, 100x107 ft., for D. Baitter. Probable cost, $65,000.

Chico, Cal.—C. J. Mathews, of Sacramento, it is reported, submitted the lowest bid for erecting a building for the Elks at $38,054.

Los Angeles, Cal.—A 2-story brick business building is to be erected at 800 S. Spring St., by P. Whiting and W. H. Mead, at a cost of $25,000.

San Francisco, Cal.—The Citizens' Security Co. intends erecting a 5-story business building at 3d and Main Sts., at a cost of $125,000.

**Items marked thus give the names of parties awarded contracts.*

San Francisco, Cal.—It is reported that a 16-story office building is to be erected by the Directors of the Bank of California.

Denver, Colo.—It is reported that H. J. Stephens is having plans prepared for a 6-story business building which he proposes erecting at 18th and Glenarm Sts., at a cost of $150,000.

J. S. Flower has plans for a 5-story brick business building which he proposes erecting at Welton and 18th Stas., at a cost of $150,000.

Jacksonville, Fla.—The Knights of Pythias, it is reported, intend erecting an 8-story building to cost about $75,000. Rutledge Holmes, West Bldg., is the archt.

Savannah, Ga.—The members of the Y. M. C. A. are said to be contemplating the erection of a new building at a cost of $75,000.

**Chicago, Ill.*—The contract for the construction of the Borland building at La Salle and Monroe Sts. has been let to the Everett Clark Co., 100 Washington St. The building will be 18 stories high, 46x94 ft., and cost about $800,000.

Frost & Granger, 184 La Salle St., are preparing plans for a depot to be built for the Chicago & Northwestern R. R. at Norwood Park. It will be a one-story structure of brick and stone and will cost $25,000.

S. M. Randolph, 138 Washington St., is preparing plans for a 7-story addition, 60x150 ft., to the mercantile building of the Durand-Kasper Co., in West Lake St., to cost $60,000.

East St. Louis, Ill.—Robt. Rutledge, of St. Louis, is reported interested in a 6-story office and theatre building which it is proposed erecting at St. Louis and Collinsville Aves., at a cost of $225,000. Leo. J. Scherer, an East St. Louis real estate dealer, is also reported interested in the project.

Evansville, Ind.—M. H. Lockyear, it is reported, is interested in the erection of a 10-story office building on Main St., to cost $209,000.

Shelbyville, Ind.—Press reports state that bids will be received until May 26 by the Bldg. Com., I. O. O. F., for erecting a lodge hall building.

Indianapolis, Ind.—Saks & Co., it is reported, will improve the Ingalls Bldg. at a cost of $50,000.

The Knights of Pythias, it is reported, intend erecting a Castle Hall on W. Ohio St., to cost $25,000.

**Sioux City, Ia.*—Frank B. Gilbreth, of N. Y. City, N. Y., it is stated, has received the contract to erect a building here for the Haley & Lang Co., at W. 3d and Water Sts., at a cost of $55,000.

Liebbe, Nourse & Rasmussen, of Des Moines, it is stated, are the archts. for a 6-story building which is to be erected at 3d and Jennings Sts. by the Warfield-Pratt-Howell Grocery Co. (L. W. Mallony, Mgr.).

Danville, Ky.—The erection of a Y. M. C. A. bldg. at a cost of $20,000 is reported under consideration.

New Orleans, La.—L. S. Berg, Pres. of the New Orleans Terminal Co., it is reported, has announced that the contract for erecting the passenger station here on Canal St. will probably be awarded some time in Aug. Probable cost $2,000,000.

A 6-story warehouse and office quarters, it is stated, is to be erected by the Fairbanks Scales Co. on Camp, Magazine and St. Joseph Sts.

**Baltimore, Md.*—Chas. Gilpin, of Philadelphia, Pa., it is stated, has received the contract to erect the 7-story brick and stone hotel for the Merchants' Hotel Co., on Howard St., which is to cost about $150,000.

**Whitinsville, Mass.*—The Central Bldg. Co., of Worcester, it is stated, has received the contract to erect the 2-story brick building for the Whitinsville Nat'l Bank at Church, Hill and Main Sts. and Railroad Ave., which is to cost $50,000.

**New Bedford, Mass.*—Henry T. Bulman, of New Bedford, it is reported, has received the contract to erect the club house for the Washington Social Club. Probable cost, $50,000.

Boston, Mass.—The Boston Lodge of Elks, it is stated, is contemplating the erection of a 6-story lodge building on Columbus Ave., to cost about $200,000.

The Butler Bros. Constr. Co., of New York City, it is reported, has received the contract to erect the Bank Bldg. for the Suffolk Savings Bank at Tremont St. and Pemberton Sq. Probable cost, $400,000.

Jackson, Mich.—The erection of a Y. M. C. A., bldg. at a cost of $75,000 is reported under consideration.

Kansas City, Mo.—Howe, Hoit & Cutler are stated to be preparing plans for a 14-story brick office building for the Long Bell Lumber Co., to be erected on 10th St. and Grand Ave., to cost $400,000.

Dr. Minor will erect a brick store building at McGee and 10th Sts., to cost $20,000.

The Carl Hoffman Music Co. will erect a brick store at 1110-12 Grand Ave., to cost $100,000. L. J. O'Shaughnessy will erect a brick office building on Wyandotte and 12th Sts., at a cost of $70.000.

**St. Louis, Mo.*—Nicholas Pelligreen, 816 Pine St., it is reported, has secured a permit to erect a business building and apartment house at Grand Ave. and Arsenal St. to cost $50,000.

Anaconda, Mont.—The Silver Bow Club Bldg. Assoc., it is stated, has filed articles of incorporation for the purpose of erecting a club house to cost about $100,000.

Missoula, Mont.—The Elks are said to be considering the erection of an opera house to cost about $50,000.

**Omaha, Neb.*—It is reported that W. L. Mardis has secured the contract to erect a warehouse for Allen Bros., wholesale grocers, at a cost of $115,000.

Buffalo, N. Y.—Improvements, it is stated, are to be made to the Saturn Club House at a cost of about $50,000.

Uhrichsville, O.—A. A. Bowers, of New Philadelphia, it is reported, proposes erecting a theatre here to cost $30,000.

Findlay, O.—C. R. Stedman, of Cleveland, it is reported, has prepared plans for a 4-story business building which it is proposed erecting on S. Main St., at a cost of about $150,000.

**Middletown, O.*—The contract for the installation of the heating and plumbing systems in the new Sebald Bldg., it is stated, has been awarded to John Arpp., of Middletown, at about $5,000.

Philadelphia, Pa.—A gift of $50,000 has been given to the Episcopal Church of St. Clements, at 20th and Cherry Sts., with which it is proposed erecting a new parish house.

*A building permit has been granted to A. Raymond Raff, 1635 Thompson St., for the theatre, hotel and factory building which is to be erected for the German Theatre Realty Co., at Franklin St. and Girard Ave., at a total cost of $160,000.

It is reported that Doyle & Doak, 1509 Sansome St., have invited bids for the erection of the $300,000 office building for the Tradesmen's Trust Co., at Juniper and Chestnut Sts.

A building permit has been granted to Geo. C. Boldt, owner, Broad and Walnut Sts., for alterations to a hotel at Broad and Walnut Sts., the cost to be $20,000.

*A building permit has been granted to Thos. Reilly, 1616 Thompson St., to remodel the building at 711 Spring St., into a clubhouse for the Mutual Republican Club, the cost to be about $25,000.

Florence, S. C.—The Masons have decided to erect a building at a cost of $18,000.

**Aberdeen, S. D.*—C. Lepper, of Blue Earth, Minn., it is reported, has received the contract to erect the Hatz Bldg., at Main St. and First Ave., at $87,500. Other bids received were: Gray Constr. Co., Watertown, at $89,325, and Schuler Bros., of Wahpeton, at $97,000.

Nashville, Tenn.—The Knights of Pythias, it is stated, are considering the erection of a building at a cost of $30,000.

Roanoke, Va.—A 6-story and basement store and office building is to be erected on Campbell and Kirk Aves. by Watt, Rettew & Clay. Baldwin & Pennington, of Baltimore, Md., are the archts.

**Tacoma, Wash.*—H. F. Allen, of Seattle, it is stated, has received the contract to erect the Temple of Music at C and Commerce Sts., at $22,307.

**Seattle, Wash.*—The International Contract Co., of Seattle, it is stated, has received the contract to erect the public market at 4th and 5th Aves. and Seneca St., the cost to be about $70,000. Saunders & Lawton, N. Y. Blk., are the archts.

Milwaukee, Wis.—Ferry & Clas, 419 Bway., it is stated, are preparing plans for a 5-story brick store and office building, which is to be erected by the Pabst Brewing Co., at Grand Ave. and 3d St.

Medicine Hat, N. W. T.—It is reported that the Canadian Pacific Ry. (W. F. Tye, Ch. Engr., Montreal, Que.) intends erecting a $20,000 depot here.

CHURCHES AND DWELLINGS.

Notes Arranged Alphabetically by States.

Denver, Colo.—J. E. Holmberg, it is stated, intends erecting a $25,000 flat at Franklin St. and 14th Ave.

Atlanta, Ga.—The members of the St. Paul Methodist Church, it is stated, have decided to erect a new edifice at Woodward Ave. and Oakland St., at a cost of $25,000.

Quitman, Ga.—The Baptists have agreed upon plans for a church which it is proposed erecting at a cost of $20,000.

Chicago, Ill.—Geo. O. Garnsey, 185 Dearborn St., has prepared plans for a 5-story apartment house, 50x100 ft., which is to be erected on Grace St. by Leslie P. Mick; estimated cost, $75,000.

Wilmore Alloway, Marquette Bldg., is preparing plans for a 3-story apartment house to be erected at 71st St. and Stewart Ave. for C. D. Armstrong. It will be 100x125 ft. and will cost $60,000.

Henry L. Newhouse, 4530 Prairie Ave., is preparing plans for a 3-story apartment house, 100x105 ft., to be erected on Grand Boule. and 50th St., for Rubel & Stern. Cost, $75,000.

Le Roy, Ill.—It is reported that J. L. Crumbaugh has left $250,000 for the founding and endowing of a Spiritualists Church here.

Baltimore, Md.—It is reported that the members of the Brown Memorial Presbyterian Church intend making improvements to the edifice at a cost of $35,000. Jas. Clendenin, Chmn. Bd. Trus.

Holyoke, Mass.—G. P. B. Alderman & Co., of Holyoke, have prepared plans for a flat house which is to be erected at Elm and Hampshire Sts., at a cost of $52,000.

St. Paul, Minn.—It is reported that bids are wanted June 2 by the Bldg. Com. (Rev. Anthony Ogulin, Chmn.), for erecting the St. Bernard Church at Albermarle and Geranium Sts. John N. Jager. archt., 415 Evanston Bldg.

New York, N. Y.—It is stated that it has been decided to erect a church house in Crotona Park to be used as the headquarters for the work of the Episcopal Church in the Bronx Boro., the cost to be about $100,000.

**Villanova, Pa.*—Chamblos & Co., it is reported, have received the contract to erect a residence and stable here for Geo. C. Thayer at a cost of $24,000. Brockie & Hastings, Philadelphia, Pa., are the archts.

South Shore, S. D.—Bids will be received until June 1 by Will Schmeling, South Shore, for erecting a German Lutheran Church here.

Loomis, S. D.—It is reported that the members of the R. C. Church intend erecting an edifice at a cost of $40,000. Address Rev. J. J. Shea, pastor.

Nashville, Tenn.—The members of the East Nashville Baptist Church, it is reported, have decided to erect a new edifice at a cost of $25,000.

Spokane, Wash.—The members of the First M. E. Church will have plans prepared at once for a new edifice to replace the one recently burned; it will cost $50,000. Architect not yet selected. Address, Rev. Henry Rasmus, Pastor.

SCHOOLS.

Notes Arranged Alphabetically by States.

**Birmingham, Ala.*—Robt. Palentine, of Birmingham, it is stated, has received the contract to erect the Barker school at $14,670.

Birmingham, Ala.—Bids will be received until May 24 by the Bd. Educ., for plumbing, electric wiring and heating the South Highland School; Miller & Martin, Archts., Hood Bldg.

Marianna, Ark.—It is reported that plans have been adopted for a school, which is to be erected at a cost of $20,000.

Denver, Colo.—Bids will be received until May 24 by the Bd. Educ. (Henry Koepcke, Secy.), for erecting an 8-room addition and other alterations and improvements to the Cheltenham School, Colfax and Irvin Sts.; David W. Dryden, Arct., 430 Temple Court.

**Washington Barracks, D. C.*—Capt. John Stephen Sewell, Corps Engr. U. S. A., Washington, D. C., writes that the contract for heating apparatus for Army War College (bids opened Apr. 29), has been awarded to Biggs Heating Co., Washington, for $32,249.

Washington, D. C.—The plans of Geo. B. Post & Sons, of New York, N. Y., have been selected as the best for the memorial hall and the grouping of the buildings for the Geo. Washington Univ. on Van Ness Park.

Wallace, Idaho.—Rev. F. A. Becker is pastor of the R. C. Church, which is contemplating the erection of a school to cost about $35,000.

**Harrisburg, Ill.*—Ford & King, it is reported, have received the contract to erect a school here to cost about $20,000.

East St. Louis, Ill.—It is reported that bids will be received June 5 by the Bd. Educ. (J. J. Reader, Secy.) for installing ventilating and heating pipes in the high school.

**Vincennes, Ind.*—The contract to erect an 8-room school has been relet to Frank Katzorkey, of Vincennes, at $31,978.

Lafayette, Ind.—The Finance Com. has been authorized to issue $16,000 bonds with which it is proposed erecting a high school on the West Side.

**Council Bluffs, Ia.*—The State Bd. of Control, at Des Moines, it is reported, has awarded the contract for the heating the main building at the School for the Deaf at Council Bluffs to J. C. Bixby & Sons, ,of Council Bluffs, at $11,984, and Grundwald & Schroeder Co., of Omaha, Neb., the contract for the plumbing of same building at $2,900.

**Fairfield, Ia.*—R. S. Williamson, of Vinton, it is reported, has received the contract to erect the 2d Ward School at $17,450, and P. J. Brady, of Fairfield, the contract for the plumbing at $993. The contract for the ventilating is yet to be awarded.

Cynthiana, Ky.—The City Council has purchased the site of the Ashbrooke Home on which it is proposed erecting a school to cost about $40,000.

Louisville, Ky.—Bids will be received May 25 by tthe Louisville School Bd., (Chas. C. Martin, Secy.) for heating the Germantown and normal school buildings.

Donaldsville, La.—Chas. Maurin, Mayor, writes that no architect has yet been selected for the proposed high school, which will cost about $50,000. Bids for construction will be called for in about 2 months.

Baltimore, Md.—Archts. Pell & Corbett, 31 Union Sq., New York, N. Y., write that bids will probably be received about July 1 for erecting the Maryland Institute for the Promotion of Mechanic Arts in Baltimore; probable cost from $350,000 to $400,000.

Williamstown, Mass.—The Bd. of Trus. of Williams College, it is reported, has directed the Com. on Bldgs., Grounds and Improv., to have plans prepared for a dormitory, which it is proposed erecting at a cost of about $150,000.

Grand Rapids, Mich.—It is reported that bids will be received until June 19 by the Bd. Educ. (Ed. H. Stein, Secy.) for erecting a 4-room addition to the school on Diamond St.

Wyandotte, Mich.—Burke, Smith & Nelson, of Muskegon, it is reported, have submitted the lowest bid for erecting a school in the 2d Ward at $41,000.

Crystal Falls, Mich.—The citizens are reported to have voted to erect a school, to cost $40,000.

Fremont, Mich.—It is reported that bids are wanted until May 25 for erecting a brick school in Dist. No. 1; address, B. E. Campbell, Fremont.

Ishpeming, Mich.—Bids will be received May 25 by Chas. Burt, Dir. School Dist. No. 1, for erecting a brick school; probable cost, $20,000. Charlton & Kunezli, Archs., Marquette, Mich.

Isanti, Minn.—It is reported that bids will be received until May 27 by the School Bd. (H. P. Dahl, Clk.) for erecting a brick school; separate bids will be received for ventilating and heating.

Dillon, Mont.—Bids will be received May 27 by A. L. Stone, Secy., Executive Bd., State Normal College, for erecting a main building for said college. Probable cost, $60,000. C. S. Haire, Archt., Helena, Mont.

**Bozeman, Mont.*—The Bd. of School Trus. has let the contract for an 8-room school to W. H. Vreeland, of Bozeman.

The Bd. of School Trus. is stated to have decided to procure bids for the plumbing and heating for both the present buildings, the east and west side schools, and the proposed new building.

Peru, Neb.—Plans will be received May 24 by the Bd. Educ. State Normal Schools, Capitol Bldg., Lincoln, Neb. (J. L. McBrien, Secy.), for a Normal School library, to cost about $30,000.

Kearney, Neb.—Bids will be received May 24 by the Bd. Educ., State Normal Schools, Capitol Bldg., Lincoln, Neb. (J. L. McBrien, Secy.) for erecting a power house on the grounds of the State Normal School here; plans and specifications may be obtained from Geo. A. Berlinghof, Arch., Beatrice, Neb., for $10.

Durham, N. H.—Bids will be received until June 3 by the Com. Bd. Trus. (John G. Tallant, Chmn.), for erecting a drill hall and gymnasium for the New Hampshire College of Agriculture and Mechanic Arts.

Orange, N. J.—Press reports state that bids will be received until June 6 by the Central School Com. of the Bd. Educ., for erecting a high school at Main and Cleveland Sts.; probable cost $90,000. Herbert D. Hale, Archt., 142 E. 33d St., N. Y. City.

**Items marked thus give the names of parties awarded contracts.*

Hasbrouck Heights, N. J.—E. C. Little, School Trus., writes that it is proposed to erect a school here to cost about $51,000. Architects, Marsh & Gette, 99 Nassau St., New York, N. Y.

Englewood, N. J.—Taylor & Mosley, 1 Nassau St., New York, N. Y., are preparing plans for a school for Englewood, to cost about $65,000. Contracts will probably be let latter part of June.

**New York, N. Y.*—The following are the bids opened May 8 by C. B. J. Snyder, Supt. School Bldgs., for installing ventilating apparatus in (*a*) School No. 63, Manhattan Boro.; (*b*) School No. 27, Brooklyn Boro; (*c*) School No. 82, Queens Boro.: Wm. J. Olvany, *a* $34,348, *c* $10,989; Frank Dobson, 218 E. 42d St., *a* $33,900, *c* $10,490 (awarded contract; Jas. Curran Mfg. Co., *a* $37,777, *b* $18,500, *c* $13,668; Wm. N. Tobin, *a* $36,470, *b* $19,212, *c* $11,175; Rossman & Bracken Co., 132 E. 42d St., *a* $32,800 (awarded contract), *b* $18,000, *c* $12,000; Blake & Williams, *a* $36,573, *b* $16,088; Dowdeswell Bros., *a* $34,500, *b* $16,971; Walker & Chambers, *a* $32,941, *b* $16,578, *c* $10,868; E. Rutzler & Co., 178 Centre St., *a* $33,729, *b* $16,466 (awarded contract), *c* $10,988; Geo. A. Suter, *a* $33,873; United Htg. Co., *b* $19,300.

*Thos. McKeown, 267 W. 30th St., has secured the contract for erecting 3 outside iron stairs at School No. 23, Manhattan Boro. (bids opened May 8) for $8,883.

Bids will be received by C. B. J. Snyder, Supt. School Bldgs., until May 22, for the general construction of School No. 81, including plumbing and drainage.

St. John's Univ., at Fordham, it is reported, has received a donation of $100,000 for the erection of a dormitory. Rev. Jas. A. Collins, pres.

*The following are the bids opened May 15 by C. B. J. Snyder, Supt. School Bldgs., for installing ventilating and heating apparatus in school No. 85, Boro. of Manhattan: Blake & Williams, 210 W. 20th St., $17,283 (awarded contract); Rossman & Bracken Co., $18,800; William N. Tobin, $18,742; E. Rutzler Co., $18,293; Frank Dobson, $17,900; Walker & Chambers, $17,790; George A. Suter, $17,943; Dowdeswell Bros., $18,989; Harry L. Philp, $18,660.

*Chris. Nally, 2398 Broadway, has secured the contract for sanitary work and gas fitting at School No. 85, Manhattan Boro. (bids opened May 15 for $7,486.

Bids will be received until May 29 by C. B. J. Snyder, Supt. Schools, for general construction, etc., of temporary School No. 7, Boro Manhattan; sanitary repairs, etc., in Schools Nos. 2 and 4, Boro Bronx.

**Brooklyn, N. Y.*—The Concord Const. Co., Harmon St. and Court Ave., has secured the contract for iron stairways, alterations, repairs, etc., to schools Nos. 15 and 54, Brooklyn Boro. (bids opened May 15) for $20,791, and Wm. Horne Co. secured the contract for work on the Girls' High School for $12,340.

All bids opened May 15 for general construction, etc., of School No. 92, Boro. Brooklyn, have been rejected and new bids will be received by C. B. J. Snyder, Supt. School Bldgs., N. Y. City, May 29. The following were the bids received: Geo. Hildebrand, $193,700; Thos. Cockerill & Son, $208,000; Richard F. Heningham, $199,500; Chas. H. Peckworth, $193,770; Clarke & Stowe, $197,700; John Auer & Sons, $201,000; P. J. Brennan, $205,000, and John Thatcher & Son, $207,000.

Bids will be received by C. B. J. Snyder, Supt. School Bldgs., New York City, for sanitary work and gas fitting in School No. 103; installing ventilating and heating apparatus in Schools No. 110 and 147 and alterations, repairs, etc., in School No. 136, all in Boro. Brooklyn.

New Brighton, S. I., N. Y.—Bids opened May 15 for general construction, etc., of School No. 7, Richmond Boro., have been rejected and new bids will be received by C. B. J. Snyder, Supt. School Bldgs., N. Y. City, May 29. Two bids were received as follows: Geo. Hildebrand, $18,434, and U. W. Osborn, $17,945.

**Saratoga Springs, N. Y.*—The Bd. of Educ., it is stated, has awarded the contract for ventilating and heating the high school to the American Warming & Ventilating Co., of Elmira, at $4,530.

Rochester, N. Y.—The Trus. of the Rochester Theological Seminary, it is stated, have received $150,000 with which to erect a dormitory to be known as Alvah Strong Hall, $75,000 to be used for construction and $75,000 for maintenance.

Lima, N. Y.—It is stated that bids will be received until May 31 by Patrick Hendrick, Chmn. Bldg. Com. for erecting a 2-story cement or concrete block school. Wm. J. Beardsley, Archt., 42 Market St., Poughkeepsie, N. Y.

Anamoose, N. D.—It is reported that bids are wanted until May 26 for erecting a 6-room brick school. Address A. J. Becmar, Anamoose.

Hilliards, O.—Bids will be received June 8 by the Bd. Educ. Norwich Township, Hilliards, (Leroy Dobyns, Clk.) for erecting a 4-room high school in Norwich Township near Hilliards, on the Hart Turnpike; Henry Maetzel & Co., Archts., 284½ S. High St., Columbus.

Lorain, O.—It is reported that bids will be received until June 5 by the School Bd. (E. E. Hopkins, Clk.) for erecting a school, including ventilating and heating.

Girard, O.—Press reports state that bids will be received until June 2 by the Bd. of Educ. for erecting an 8-room school at North Ave. and Prospect St.; also same date for erecting a 4-room addition to the High School, State and Elm Sts.; J. Marcus Miller, Arch., 410 Dollar Savings Bank, Youngstown.

Marion, O.—The Bd. of Educ. has adopted a resolution authorizing the issue of $30,000 school bonds.

The Bd. of Educ. has authorized competitive plans to be received until May 22 for a school to cost $20,000.

Wellsville, O.—Bids will be received June 6 by the Bd. Educ. (J. F. McQueen, Clk.) for erecting a 2-story brick school on 18th St.; bids will be received separately for labor and material; probable cost, $12,000. A. W. Scott, Jr., Archt., E. Liverpool.

Cleveland, O.—A site has been selected on N. Logan and Euclid Aves. on which it is proposed erecting the combined Hathaway-Brown and Laurel schools. Plans have been prepared by Hubbell & Benes, Citizens' Bldg., for the proposed new building which provide for a 3-story brick structure to cost about $70,000.

Bids will be received June 12 by the Bd. Educ. for furnishing materials and erecting annex to the Detroit School, including plumbing, ventilating and heating and electric wiring; Chas. Orr, Dir. Schools.

It is stated that bids will be received until May 24 by Emile M. Uhlrich, archt., The Arcade, for erecting a fireproof school, 100x130 ft. for the church of Our Lady of Lourdes, Randolph St. Probable cost, $50,000.

Stillwater, Okla. Ter.—The Bd. of Regents, it is reported, has decided to receive competitive plans in June for the new building to accommodate the industrial department at the Stillwater Agricultural & Mechanical College, which is to cost about $60,000. There remains $32,000 of the amount appropriated for work at this college with which it is proposed erecting shops and equipping a gymnasium.

Glassport, Pa.—The Boro. School Bd., it is stated, has adopted plans for a brick school which is to be erected at Otto Station at a cost of $20,000.

**Pittsburg, Pa.*—Kerr & Fox, 2565 5th Ave., it is stated, have received the contract to erect a 12-room school at Fulton and Gum Sts., to cost about $60,000.

*The Duquesne Constr. Co., it is stated, has received the contract to erect a brick school for the church of St. Peter and Paul, in Larimer Ave., at a cost of $55,000.

**Philadelphia, Pa.*—Contracts for school improvements, it is stated, have been awarded as follows, bids for which were received May 16: Southern Manual Training School, Broad and Jackson Sts., Cramp & Co., 1412 Filbert St., $361,937; A. D. Bache School, 22d and Brown Sts., J. R. Wiggins & Co., 721 Heed Bldg., $124,000; Minnie Murdoch Kendrick School, 38th St. and Powelton Ave., J. R. Wiggins & Co., $63,000; school at 32d and Berks Sts., 32d Ward, E. F. Fonder & Co., Land Title Bldg., $84,000; school at Rhawn and Dittman Sts., Thos. Reilly, 1616 Thompson St., $53,466.

Other bids received on May 16 for school improvements, for which Archt. has been asked to modify plans, and it is probable that new bids will be asked, are reported to have been as follows: (*a*) school at 62d St. and Lebanon Ave., appropriation $25,000; (*b*) school at 41st and Edgely Sts., appropriation $20,000: Lynch Bros., *a* $39,700, *b* $25,600; Metzger & Wells, *a* $40,940, *b* $28,350; Henderson & Co., *a* $41,386; *b* $26,230; John Morris, *a* $44,299, *b* $30,930; David Peoples, *a* $45,044, *b* $30,768; Cramp & Co., *a* $45,600, and The Stewart Constr. Co., *b* $37,900.

**Philadelphia, Pa.*—A building permit has been granted to Herman Voight, to erect a 1-story parochial school, 54 x124 ft. and a 3-story rectory 43x30 ft. for St. Ignatius R. C. Church at 43d and Wallace Sts., to cost $33,000.

Memphis, Tenn.—School bonds amounting to $125,000 have been sold.

Dodgeville, Wis.—Bids will be received May 23 by the Bd. Educ. (Thos. Sims, Clk.) for erecting a school; separate bids will be received for heating said building; probable cost, $25,000; plans and specifications may be secured upon a deposit of $5. Chandler & Parks, Archts., Racine, Wis.

**Madison, Wis.*—The Bd. of Educ., it is stated, has awarded the contract to erect the high school to T. C. McCarthy, of Madison, at about $220,000 (bids received May 2).

La Crosse, Wis.—John P. Bird, Supt. Bd. Educ., writes that the plans of J. L. Llewellyn, 1st Natl. Bank, Chicago, Ill., have been accepted for a new high school.

STREET CLEANING AND GARBAGE DISPOSAL.

Notes Arranged Alphabetically by States.

Detroit, Mich.—The Wayne delegation is stated to have agreed to report favorably the bill authorizing a $100,000 bond issue for a garbage plant.

Ann Arbor, Mich.—The Governor is reported to have signed a bill authorizing this city to construct a garbage crematory.

Bradley Beach, N. J.—Bids will be received until May 29 by W. C. McDonald, Boro. Clk., for removal of garbage and rubbish for a period of 2 years.

Philadelphia, Pa.—Local press reports state that bids will be received until June 16 by Peter Costello, Dir. Pub. Wks., for cleaning streets, collecting and removing ashes.

Ft. Worth, Tex.—The City Council is considering the construction of a garbage crematory. John B. Hawley, City Engr.

NEW INDUSTRIAL PLANTS.

See also Business Buildings.

The Davenport, Ia., Foundry & Machine Co. will improve its plant by the erection of an 88x100-ft. brick foundry and an additional story to its machine shop, to be used as a pattern shop, according to local newspaper reports.

H. F. Sommer & Co., Newark, N. J., will spend about $70,000 on additions to their plant, which will include a tannery, japaning shop, and boiler and engine house, according to local newspaper reports.

Wm. Steele & Sons, Philadelphia, Pa., will erect a 4-story, 71x101-ft. factory building on Eyre St., near Tulip for the A. J. Reach Co., and a 5-story, 54x140 ft. store and factory building at 722 Market St. for Kohn, Adler & Co., according to local newspaper reports.

Morgan & Wright, Chicago, Ill., manufacturers of rubber goods, will erect a plant in Detroit, which will include two 5-story, 300x63-ft. manufacturing buildings; a 5-story, 200x63-ft. storehouse; a 3-story, 163x87-ft. machine shop; an 83x59-ft. cement shop building and a 3-story, 50x75-ft. office building. The engine room will be 110x81 ft., and will contain two cross compound condensing engines of 1,000 h.p. each. The boiler house will be 151x42 ft., and will contain ten 250 h.p. boilers. V. B. Lang, Supt. of Power and Machinery.

James Foster, 3050 Ludlow St., Philadelphia, Pa., will erect a 6-story, 50x99-ft. brick factory building at a cost of $20,000, according to local newspaper reports.

Foley Bros. & Larson, Jackson, Miss., will erect a large lumbering plant and a railroad from Jackson up the Pearl River Valley.

The Westcott & Trenchard Lumber Co., Gumberry, N. C., writes that it is not yet ready to give out details concerning the plant it will erect.

A. W. & W. M. Watson, Newtown, Pa., will erect a saw and planing mill in place of one recently burned. The power plant was saved.

The Bacon-Underwood Veneer Co., Mobile, Ala., will erect a 200x90-ft. main building and four 100x50-ft. buildings. A 250-h.p. Hamilton Corliss engine will be installed.

Cawley, Clark & Co., Newark, N. J., color manufacturers, write that they intend to begin rebuilding their plant which was recently burned as soon as possible, but details have not yet been decided.

The Lonsdale Face Brick Co., Knoxville, Tenn., intends to increase the capacity of its plant next fall and winter.

The Gwyn Veneer & Panel Co., Lenoir, N. C., writes that it has not yet decided the size of the building to be erected or the capacity of the power plant to be installed.

Catogni Bros., Roanoke, Va., lumber manufacturers, intend to rebuild their plant, which was burned with a loss of about $20,000, but details have not yet been decided.

The Reliance Worsted Co., Norwich, Conn., is rebuilding a 200x50-ft. building, which it is intended to use for spinning, spooling and winding.

The Watson Wagon Co., Canastota, N. Y., has bought four or five acres adjoining its plant and expects to erect several additions, which will include a 45x66-ft. addition and a 3-story, 50x288-ft. addition. It is expected that this will increase the capacity of the plant to 15 to 20 wagons daily.

Dodge & Day, engineers and architects, Philadelphia, Pa., have been commissioned by Wm. Knabe & Co., Baltimore, Md., piano makers, to take entire charge of entensive improvements to their plant. The operation includes a new 5-story building 225x50-ft., new dry kiln and wood mill, as well as numerous changes to the present buildings. There will also be a new power plant, which will involve the purchase of a new engine and generator. Motors will be installed and considerable electrical work done, as it is the intention to operate the plant electrically throughout.

The Nagle Engine & Boiler Works, Erie, Pa., have nearly completed their new plant, the only machinery still required being machine tools.

The Upton Motor Co., Lebanon, Pa., expects to add a story to a 2-story, 60x200-ft., building, which will be used as an assembling room for the company's cars.

The Acworth, Ga., Cotton Mfg. Co. will erect a 75x281-ft. building to make hosiery yarns and expects to install 5,000 spindles. Orlando Awtrey, Pres.

The Fagan Iron Works, Hoboken, N. J., have started rebuilding their foundry which was recently burned. The foundry will be 200x100 ft.

The Lillian Knitting Mills Co., Albemarle, N. C., will erect a 2-story, 50x100-ft. building, with additional boiler and dye house. A 25-h.p. automatic engine and a 50 to 75-h.p. boiler will be installed. A tube well will be sunk. A. L. Patterson, Secy. and Treas.

The Springfield, Ill., Boiler & Mfg. Co. expects to erect a 130x350-ft. shop, to be composed of one main span 50 ft. wide with a 40-ft. bay on each side. The company is also considering the installation of a direct-connected electrically-driven air compressor of 500 to 600 cu. ft. capacity for 100 lb. pressure and a direct-connected hydraulic pump to work against a pressure of 1,500 lb.; the motor to be used will be a three-phase, 440-volt, alternating-current motor. It has not yet been decided what generating outfit will be installed.

A correspondent writes that the National Folding Box & Paper Co., New Haven, Conn., will erect a 4-story brick factory 361 ft. on James St., 207 ft. on Alton St., and 336 ft. on Main St. Cost, $140,000. The H. Wales Lines Co., contractor.

O. J. Trainor's Son, New Iberia, La., will install in the woodworking plant he is to erect a 75-h.p. engine with rope drive and new woodworking machines.

The Pacolet, S. C., Mfg. Co. writes that the details of the new mill to be erected have not yet been decided and that it will be possibly two or three weeks before plans for the building will be received, at which time it is expected to begin work on it.

The North Carolina Tobacco Growers' Protective Association expects to build tobacco factories in the tobacco-producing states, but nothing definite has as yet been done. J. O. W. Gravely, Rocky Mount, N. C., Secy.

M. H. Houser, Pomeroy, Wash., intends to rebuild the Pomeroy Flouring Mills, recently burned, as soon as the necessary arrangements can be made. The capacity will be 150 to 250 bbl.

The Atlantic Coast Line R. R. Co. is installing a new car-shop plant at Waycross, Ga. The shops will be arranged on the transfer table scheme, and will include a 100x312-ft. machine shop, 70x310-ft. boiler and smith shop, 100x310-ft. coach shop, and 160x310-ft. paint shop. The auxiliary departments include an 80x160-ft. foundry, 70x125-ft. planing mill, 55x200 ft. storehouse and 2 power houses. The freight car shop is to have capacity for 28 cars under cover and outside storage for 153 cars under light repairs. R. E. Smith, Gen. Supt. Motive Power, Wilmington, N. C.

The Detroit Trust Co., receiver Hecla Portland Cement & Coal Co., announces a foreclosure sale at Bay City, Mich., June 7, which will include 160 acres near the mount of Sagniaw River which is partly occupied by the cement plant; 1,040 acres of marl deposits in Ogemaw Co., Mich.; 2,600 acres approximately, in Alpena Co., containing large deposits of lime rock suitable for the manufacture of cement; large tracts of other lands acquired for various purposes; leasehold interests on 1,850 acres of coal fields, one of which of about 800 acres, is equipped with a complete and modern apparatus above as well as below ground and the output has been used under the boilers and in the kilns of the cement company; the buildings and general equipment of the cement plant at Bay City, which are mostly of concrete construction; the marl drying plant near the marl deposits and the mine; boarding houses, cottages for the working men, and many other auxiliary buildings.

Light & Linberger, Avon, Pa., whose stocking factory was recently burned, will rebuild, but dimensions have not yet been determined.

The American Tap & Die Co., Springfield, Mass., will erect a 50x100-ft. building, with 50x56-ft. basement, and will install a 15-h.p. motor.

The Urie Boiler & Machine Co., Kansas City, Mo., will erect a 205x100-ft. main brick building, with 25-ft. span through the center to receive a 10 and a 5-ton traveling crane. There will also be a foundry and erecting shop, about 100x150 ft. About 75 h.p. will be utilized, and all the hoists will be operated by compressed air.

**Items marked thus give the names of parties awarded contracts.*

MISCELLANEOUS.

Notes Arranged Alphabetically by States.

Mobile, Ala.—Bids will be received by Maj. W. E. Craighill, Corps Engrs., U. S. A., June 15 for dredging Mobile Bar, Ala., and Horn Island Pass, Miss., as advertised in The Engineering Record.

Port Harford, Cal.—Capt. C. H. McKinstry, Corps Engrs., U. S. A., Bradbury Bldg., Los Angeles, writes that the City Street Improv. Co., Mills Bldg., San Francisco, bid on May 11 for about 8,868 short tons of rubble stone for breakwater in San Luis Obispo Harbor $2.65 per ton. Amount available, $23,500.

Coronado, Cal.—The property owners are reported to have adopted the report of the Citizens Com. (Bartlett Richards, Chmn.) for the construction of a sea wall, to cost about $134,000. An election to vote on issuing bonds will probably soon be held. Andrew Ernst, City Engr.

Wilmington, Del.—Bids will be received until June 10 by Capt. C. A. F. Flagler, Corps Engrs., U. S. A., Wilmington for dredging in Murderkill River, Del.

Washington, D. C.—Bids will be received by Maj. S. W. Roessler, Corps Engrs., U. S. A., June 20, for furnishing and delivering 36-in. searchlight outfits, as advertised in The Engineering Record.

Jacksonville, Fla.—Bids will be received by Maj. Francis R. Shunk, Corps Engrs., U. S. A., June 15, for removing wrecks of the Ridgewood and Commodore Barney in St. Johns River, Fla., as advertised in The Engineering Record.

Ft. Screven, Ga.—Bids will be received until June 5 by Jos. T. Davidson, Q. M., U. S. A., Savannah, for constructing jetties at Ft. Screven, as advertised in The Engineering Record.

Chicago, Ill.—Lieut. Col. Wm. H. Bixby, Corps Engrs., U. S. A., writes that the following are the bids opened May 15 for rock excavation in Calumet River: (*a*) 61,550 cu. yds., price per cu. yd., (*b*) total: Buffalo Dredging Co., Buffalo, N. Y., *a* $2.98, *b* $183,419; the L. P. & J. A. Smith Co., Cleveland, O., *a* $3.20, *b* $196,960; the Fitz Simmons & Connell Co., Chicago, *a* $2.95, *b* $181,572; Sam. O. Dixon, Milwaukee, Wis., *a* $3.27, *b* $201,268; Great Lakes Dredge & Dock Co., Chicago, *a* $2.25, *b* $138,487. There is also to be added to the above amounts the cost of excavating 150,000 (estimated) cu. yds. of soft material at 20 cts. per cu. yd., or $30,000.

**Laporte, Ind.*—The Northern Constr. Co. of Elkhart is stated to have secured the contract for constructing a ditch south of Laporte, for about $15,000.

Terre Haute, Ind.—About 4 miles of levee work is contemplated on west side of Wabash River, to protect 2,000 acres from Wabash River overflow. Land lies between Big Four R. R. and National Road. N. S. Kidder, City Engr.

Onawa, Ia.—Bids will be received by the Boards of Superv. of Monona and Harrison Counties at Onawa, June 8, for the construction of a drainage ditch, a distance of 23 miles, as advertised in The Engineering Record.

Maysville, Ky.—Bids will be received June 13 by Lieut.-Col. E. H. Ruffner, Corps Engrs., U. S. A., Custom House, Cincinnati, O., for completing concrete ice pier (3 sections) in Ohio River at Maysville.

Louisville, Ky.—Bids will be received by Capt. H. Burgess, Corps Engrs. U. S. A., June 15, for steel trestles, etc., for Boule. Dam, as advertised in The Engineering Record.

**Baltimore, Md.*—John S. Doyle, Engr. of Parks, writes that the contract for constructing a bulkhead at Swann Park (bids opened May 3) has been awarded to Armstrong & Latta of Philadelphia, Pa., at $18.88 per ft. for wooden and $20.60 per ft. for stone bulkhead.

Lynn, Mass.—Bids will be received by Col. W. S. Stanton, Corps Engrs., U. S. A., Boston, June 12, for dredging in Lynn Harbor, as advertised in The Engineering Reocrd.

Boston, Mass.—Bids will be received by Col. W. S. Stanton, Corps Engrs., U. S. A., June 14, for rubblestone delivered in breakwater at Sandy Bay, Mass., as advertised in The Engineering Record.

Bids will be received by the Charles River Basin Comn., June 1, for building Sect. 2 of the Boston Marginal conduit, as advertised in The Engineering Record.

West Newton, Mass.—Contracts will soon be let for building about 100-ft. covered brook channel. 6x40 ft., concrete, and 100-ft. open channel for Hammond Brook, Newton Centre. Address, Irving T. Farnham, City Engr., West Newton.

**Macon, Mo.*—Thos. M. Meyer, County Surv., writes that the contract has already been let for constructing the ditch or canal 9 miles in length, to divert course and straighten Chariton River. Engineer, W. Wilker, of Macon.

Newark, N. J.—Bids will received by the Essex County Park Comn. (A. Church, Secy.) until May 23, for constructing roadways, drainage, etc., on portions of Park Ave., and grading and improving certain portions of the southern and middle divisions of Branch Brook Park. Engineer's estimate, approximately: 12,500 cu. yds. earth excav.; 1,600 lin. ft. 8-in. 300 lin. ft. 12-in. 800 lin. ft. 10-in. vitr. pipe; 12 24-in. lawn basins; 14 road basins; 1,050 cu. yds. concrete retaining wall; 1,350 lin. ft. straight and 1,200 lin. ft. curved axed. curb; 650 sq. yds. roadway gutters, 5,500 sq. yds. 8-in. and 7,500 sq. yds. 12-in. telford road.

New York, N. Y.—Lieut. Col. W. H. Marshall, Corps Engrs., U. S. A., writes that the following are the bids opened on May 12 for removal of rock in North River, off Pier A, N. Y. Harbor: John D. Miller, 39 Cortlandt St., $40,000, and R. G. Packard Co., 130 Pearl St., $43,445.

New York, N. Y.—Bids will be received May 26 by the Dept. Docks and Ferries (Maurice Featherson, Comr.) for furnishing materials and constructing a pier bet. 42d and 43d Sts., to be known as Pier No. 83, North River; also same date for furnishing and delivering 1,000 piles (80 to 85 ft. in length), both in Boro. of Manhattan; bids will also be received same date for furnishing materials and dredging about 8,000 cu. yds. in the Boros. of Richmond and Brooklyn.

Bids will be received by Maurice Featherson, Comr. of Docks, until May 29 for furnishing materials required, preparing for and repairing, altering and extending the present ferry structures at the ft. of Whitehall St., East River, and for dredging thereat.

**New York, N. Y.*—The following are the bids opened May 15 by the Dept. Docks and Ferries for constructing pier at foot of Janes Lane, East River, to be known as Pier No. 11: Bart. S. Cronin, $41,500; Snare & Triest Co., $41,555; John Monks & Sons, 82 Beaver St., $36,808 (awarded contract); Augustin Walsh, $47,950; Wm. H. Jenks, $56,140; N. Y. State Constr. Co., $40,885; Bernard Rolf, $43,188; Geo. W. Rogers, $44,845; General Contracting & Eng. Co., $40,855, and R. P. & J. H. Staats, $44,235.

Bids were opened same time and place for about 10,000 bbl. Portland cement: (price given per bbl): Standard Material Co., $1.42½; Commercial Wood & Cement Co., $1.54, and John P. Kane Co., 287 4th Ave., $1.37 (awarded contract).

Ft. Wood, N. Y. H., N. Y.—Bids will be received by Capt. Traber Norman, Q. M., U. S. A., at Governor's Island, June 5, for constructing an addition to wharf with railroad and warehouse on wharf, at Ft. Wood, as advertised in The Engineering Record.

**St. George, S. I., N. Y.*—The contract for furnishing material, removing present structures and building new ferry structures in connection with the St. George ferry terminal and dredging thereat (bids opened May 1) was on May 10 awarded by the Dept. of Docks and Ferries, N. Y. City, to G. B. Spearin, 17 Battery Place, N. Y. City, for $510,294.

West Point, N. Y.—Bids will be received by the Quartermaster, U. S. M. A., June 14, for building and plumbing materials, gas and steam fittings, tools, etc., as advertised in The Engineering Record.

*The Robbins Conveying Belt Co., of N. Y. City, has secured the entire contract for the coal-conveying apparatus at West Point, for the U. S. Government.

Wilmington, N. C.—Bids will be received June 8 by A. M. Waddell, Mayor, for furnishing supplies, including bricks, lime, cement and terra cotta pipe.

**Marion, O.*—H. H. Noyes, Co. Surv., writes that the contract for constructing and completing a change in the outlet of Silver St. Ditch in Marion (bids opened May 11), has been awarded to P. Drake & Sons, of Marion, for $1,975.

Cleveland, O.—Bids will be received until May 25 by Lieut. Col. Dan C. Kingman, Corps Engrs., U. S. A., 262 Huron St., for removing wreck of the steamer Shenango No. 1, near entrance to Conneaut Harbor, O.

Gallipolis, O.—Bids will be received June 13 by Lieut. Col. E. H. Ruffner, Corps Engrs., U. S. A., Custom House, Cincinnati, for constructing concrete section of ice pier in Ohio River at Gallipolis.

Columbus, O.—Bids will be received May 31 by the State Bd. Pub. Wks. (Chas. E. Perkins, Ch. Engr.) for furnishing materials and improving the Northern Division of the Ohio and Erie Canal, consisting of cast and wrought iron, spikes, bolts, etc., for locks, lock gates and repairs to dams and other structures; superstructures and trunks for 3 aqueducts; total estimated cost, $15,000.

Mansfield, O.—Bids will be received by the Bd. Pub. Service, June 1, for furnishing 2,000 bbls. Portland cement, as advertised in The Engineering Record.

Panama.—Bids will be received by the Isthmian Canal Comn., Washington, D. C., June 15, for excavating an entrance to and an inner harbor at Colon, Canal Zone, as advertised in The Engineering Record.

Panama.—The following are the bids opened by the Panama Canal Comn. at Washington, D. C., May 16 for (*a*) one 10-ton and (*b*) one 20-ton locomotive crane, (1) New York delivery (2) to be delivered at Colon: Browning Eng. Co., New York, N. Y. (*a*1), $7,315; (*a*2), $8,179; (*b*1), $7,775; (*b*2), $8,660. Brown Hoisting Machine Co., New York, N. Y., (*a*2), $9,190; (*b*2), $11,285. Industrial Works, Bay City, *a*, $6,990; *b*, $8,112. Wellman-Sievers-Morgan Co., New York, N. Y., *a*, $8,400. American Hoist & Derrick Co., St. Paul, Minn., *a*, $6,600; *b*, $9,000.

Erie, Pa.—Lieut. Col. H. M. Adams, Corps Engrs. U. S. A., Buffalo, N. Y., writes that the following are the bids opened May 15 for channel and basin excav. at Erie Harbor, Pa.: (*a*) 10,000 cu. yds. excav. (scow meas.) entrance of channel, per cu. yd.; (*b*) 178,000 cu. yds. excav. (place meas.) Harbor basin, per cu. yd.; (*c*) total: Buffalo Dredging Co., Buffalo, *a* 25 cts.; *b* 28½ cts.; *c* $53,230. Daly & Hannan, Dredging Co., Ogdensburg, *a* 26 cts.; *b* 29 cts; *c* $54,220. Lake Erie Dredging Co., Buffalo, N. Y., *a* 23 cts; *b* 25 cts.; *c* $46,800.

Philadelphia, Pa.—Bids will be received until June 14 by Maj. J. C. Sanford, Corps Engrs., U. S. A., for taking down the skeleton iron tower at the abandoned Port Penn Range Rear Light Station, Del., and erecting it on a new foundation at the Listons Range Rear Light Station, Del.

Providence, R. I.—The following are the bids opened May 15 by Lieut. Col. J. H. Willard, Corps Engrs., U. S. A., Newport, for dredging Providence River and harbor; amount available for this work $100,000 (price given per cu. yd.): J. S. Packard Dredging Co., Providence, 8.97 cts.; Henry DuBois Sons' Co., N. Y. City, N. Y., 11 cts.; The International Contr. Co., N. Y. City, N. Y., 9.87 cts.; R. G. Packard Co., N. Y. City, N. Y., 11 cts.; Chas. W. Eaton, Haverhill, Mass., 12 cts.; Morris & Cummings Dredging Co., N. Y. City, N. Y., to 5 cts.; Columbia Dredging Co., 64 Broad St., N. Y. City, N. Y., 8.45 cts.

Memphis, Tenn.—The County Comrs. are reported to have empowered a committee of three to issue the $100,000 bonds recently authorized, for the purpose of constructing and repairing Shelby County levees and roads.

National Soldiers' Home, Va.—Bids will be received May 23 by B. A. Beeson, Treas., N. H. D. V. S., Va., for constructing about 850 ft. timber revetment.

Norfolk, Va.—Bids will be received by Mordecai T. Endicott, Ch. Bureau Yards and Docks, Navy Dept., Washington, D. C., until June 3, for dredging about 25,000 cu. yds. of material at the Navy Yard, Norfolk.

Bremerton, Wash.—The following are the bids opened on May 6 by the Bureau of Yards & Docks, Navy Dept., Washington, D. C., for extension of quay wall west of dry dock at the Navy Yard, Puget Sound (each bid contains certain deductions and modifications): J. H. Randall, 211 2d Ave., Seattle, $45,756; the Contracting Eng. Co., Fidelity Bldg., Tacoma, $47,847; Franklin Fireproofing Co., Wilson Bldg., Dallas, Tex., $43,500; International Contract Co., New York Block, Seattle, $43,959; Cotton Bros. & Co., Bacon Bldg., Oakland, Cal., $52,833; Burrell Constr. Co., Central Bank Bldg., Oakland, Cal., $48,440; Timothy Ryan, Sullivan Blk., Seattle, $46,400, and Puget Sound Bridge & Dredging Co., Seattle, $45,000.

Guantanamo, Cuba.—The following are the bids opened on May 6 by the Bureau of Yards & Docks, Navy Dept., Washington, D. C., for (*a*) 2 traveling cableways for the Naval Sta., Guantanamo, according to specifications, (*b*) for the 2 machines of a type of the same general character which will meet the requirements of the Government: The Snare & Triest Co., 143 Liberty St., New York, N. Y., *a* $41,910; Mead, Morrison Mfg. Co., 11 Bway., New York, N. Y., *a* $44,000; Lambert Hoisting Engine Co., 115 Poinier St., Newark, N. J., *a* (2 bids) $23,836 and $26,236, *b* (2 bids) $20,236 and $22,636.

New Campbellton, N. S.—It is stated that bids will be received until May 25 by the Dept. Pub. Wks., at Ottawa, Ont. (Fred. Gelinas, Secy.) for reconstructing top of wharf and constructing retaining wall, pile and crib work here.

Rondeau, Ont.—Bids will be received May 29 by the Dept. Pub. Wks., Ottawa (Fred. Gelinas, Secy.) for constructing 2 breakwaters at Rondeau.

PROPOSALS OPEN

For Proposals see pages 52, 53, 56, 57, 58, 59, 60 and 61.

WATER WORKS.

May 23.	Mains, Deer River, Minn.	May	20
May 24.	Engine, Perth Amboy, N. J. Adv. May 13 to 20.	May	13
May 24.	Mains, Brooklyn, N. Y.	May	20
May 24.	Plans, Newark, O.	May	20
May 27.	Meters, hydrants, etc., Panama. Adv. May 6 to 20.	May	6
May 27.	Mains, etc., Portland, Me.	May	13
May 27.	Boilers, Brantford, Ont.	May	20
May 27.	Mains, Seattle, Wash.	May	20
May 29.	Engines, Woonsocket, R. I.	May	20
May 30.	Pipe, Newmarket, N. H.	May	20
May 31.	Reservoir, New York, N. Y.	May	13
May 31.	System, Shiprock, N. M.	May	13
May 31.	Boilers, Chicago, Ill.	May	20
Jun. 1,	Canal, etc., Glendive, Mont. Adv. Ap. 8 to May 13.	Apr.	8
Jun. 1.	Main, Preston, Minn.	May	20
Jun. 2.	Engines, etc., Cincinnati, O.	May	6
Jun. 2.	System, Tulalip, Wash.	May	13
Jun. 2.	Gravity system, Bristol, Vt. Adv. May 20.	May	20
Jun. 5.	Irrig. work, Yuma, Ariz. Adv. May 6 to 20.	May	6
Jun. 5.	Reservoir, etc., Crestline, O. Adv. May 20.	May	20
Jun. 5.	Mains, Lakewood, O.	May	20
Jun. 5.	Water Wks., Belding, Mich.	May	20
Jun. 5.	Pipe, Montgomery, Ala.	May	20
Jun. 5.	Air compressors, etc., Montgomery, Ala.	May	20
Jun. 6.	Tunnel, etc., Toronto, Ont. Adv. May 6 to 20.	May	6
Jun. 6.	System, Northfield, Vt. Adv. May 20.	May	20
Jun. 8.	Franchise, Ventura, Cal.	May	6
Jun. 12.	Pipe, Whittier, Cal. Adv. Apr. 22 to May 20.	May	13
Jun. 12.	Well, Whittier, Cal. Adv. May 13.	May	13
June 12.	Pump, etc., Whittier, Cal. Adv. May 13.	May	13
Jun. 13.	Laying pipe, etc., Cincinnati, O. (2 prop.). Adv. May 20 to May 20.	May	20
Jun. 14.	Well, Ft. Caswell, N. C. Adv. May 20.	May	20
Jun. 15.	Canal, etc., Minidoka, Idaho Adv. Apr. 29 to May 20.	Apr.	22
Jun. 15.	Dam, etc., Casper, Wyo. Adv. Apr. 29 to May 20.	Apr.	29
Jun. 15.	Controlling works, etc., Tahoe, Cal. Adv. May 6 to 20.	May	6
Jun. 15.	Purification wks., etc., Columbus, O. Adv. May 13, 20.	May	13
Jun. 19.	Purchase of engines, etc., Cleveland, O. Adv. May 20.	May	20
Jun. 24.	Reservoir, Guantanamo, Cuba.	May	20
Jun. 28.	Irrig. work, Billings, Mont. Adv. May 6 to 20.	May	6
Jun. 28.	Pump sta., etc., Huntley, Mont. Adv. May 6 to 20.	May	6
Jun. —.	Prescott, Wash.	Apr.	1
Jun. —.	Alma, Wash.	Apr.	22
Jun. —.	Pumps, etc., Richland, Ga.	Apr.	22
Jun. —.	Pipe, etc., Thibodaux, La.	Apr.	22
Jun. —.	Improv., Tex.	Apr.	29
———	Granbury, Tex.	Apr.	29

SEWERAGE AND SEWAGE DISPOSAL.

May 22.	Titusville, Pa.	May	22
May 23.	Painesville, O.	May	13
May 23.	New Brighton, S. I., N. Y.	May	20
May 23.	New Haven, Conn.	May	20
Ma 24.	Danbury, Conn.	May	20
May 24.	Marion, O.	May	20
May 25.	North Plate, Neb., Adv. May 6 to 20.	May	6
May 25.	Cleveland, O.	May	20
May 25.	Ballston, Spa, N. Y. Adv. May 13, 20.	May	13
May 26.	Newark, O.	May	20
May 26.	Austin, Minn.	May	20
May 27.	Hopkinsville, Ky.	May	13
May 27.	Lake City, Minn.	May	20
May 29.	Cincinnati, O.	May	6
May 29.	Pipestone, Minn.	May	20
May 31.	Shiprock, N. M.	May	13
May 31.	Pine Bluff, Ark. Adv. May 13, 20.	May	13
May 31.	Columbus, O.	May	20
May 31.	Brooklyn, N. Y.	May	20
May 31.	Merrill, Wis.	May	20
May 31.	New York, N. Y.	May	20
May 31.	Buffalo, N. Y.	May	20
May —.	New Britain, Conn.	Apr.	8
June 1.	Darlington, S. C. Adv. May 13, 20.	May	13
Jun. 1.	Mansfield, O.	May	20
June 2.	Tulalip, Wash.	May	13
June 5.	Webb City, Mo. Adv. May 13, 20.	May	13

**Items marked thus give the names of parties awarded contracts.*

Jun. 5. Plainfield, N. J. ..... May 20
Adv. May 20.
Jun. 6. Rockford, Ill. Adv. May 20 ..... May 20
Jun. 9. Cincinnati, O. ..... May 20
Jun. 17. Oconto, Wis. ..... May 20
Adv. May 20.
Jun. 20. Waterbury, Conn. ..... May 20
Adv. May 20.
June —. Sacramento, Cal. ..... May 13

BRIDGES.

May 23. French Lake, Minn. ..... May 13
May 23. Toledo, O. ..... May 13
May 23. Boston, Mass. ..... May 20
May 24. Ellendale, N. D. ..... Apr. 29
May 25. Zanesville, O. ..... May 6
May 25. West Newton, Pa. ..... May 13
May 25. Boston, Mass. ..... May 20
May 26. Reading, Pa. ..... May 20
May 29. Doylestown, Pa. ..... May 20
May 29. Cleveland, O. ..... May 20
May —. New Britain, Conn. ..... Apr. 8
Jun. 1. Lima, O. ..... May 13
Jun. 1. Mallory, Minn. ..... May 13
Jun. 1. Waterford, Pa. ..... May 20
Jun. 1. Crookston, Minn. ..... May 20
Jun. 1. Indianapolis, Ind. ..... May 20
Jun. 3. Mifflintown, Pa. ..... May 20
Jun. 5. Lancaster, Pa. ..... May 20
Jun. 5. Versailles, Ind. ..... May 20
Jun. 5. Fulton, Miss. ..... May 20
Jun. 5. Wilkesbarre, Pa. ..... May 20
Jun. 6. Dayton, O. ..... May 13
Adv. May 13, 20.
Jun. 6. Marion, O. ..... May 20
Jun. 6. Perth, Ont. ..... May 20
Jun. 7. Lafayette, Ind. ..... May 20
Jun. 10. Rockville, Ind. ..... May 20
Jun. 15. Ainsworth, Neb. ..... May 20
Jun. 17. Chesley, Ont. ..... May 20
Jun. 20. Cadillac, Mich. ..... May 13
Adv. May 13, 20.

PAVING AND ROADMAKING.

May 23. Painesville, O. ..... May 13
May 23. Red Jacket, Mich. ..... May 13
Adv. May 13, 20.
May 23. Madisonville, O. ..... May 13
May 23. New Brighton, S. I., N. Y. ..... May 20
May 23. Wilmington, Del. ..... May 20
May 23. Warren, O. ..... May 20
May 23. Syracuse, N. Y. ..... May 20
May 24. Brooklyn, N. Y. ..... May 13
May 24. Ft. Leavenworth, Kan. ..... May 13
May 24. Wilmette, Ill. ..... May 20
May 25. Reading, Pa. ..... May 13
May 25. Freport, Pa. ..... May 20
Adv. May 20.
May 25. Brantford, Ont. ..... May 20
May 25. Independence, Mo. ..... May 20
May 26. Arnprior, Ont. ..... May 13
May 26. Newark, O. ..... May 20
May 27. Ft. Ontario, N. Y. ..... Apr. 29
Adv. Apr. 29 to May 20.
May 27. Seattle, Wash. o ..... May 20
May 27. Portland, Me. ..... May 13
May 29. Cincinnati, O. ..... May 6
May 29. New Orleans, La. ..... May 20
May 29. West Carrollton, O. ..... May 20
May 31. Washington, D. C. ..... May 13
May 31. San Francisco, Cal. ..... May 13
May 30. Cleveland, O. ..... May 20
Jun. 1. Hutchinson, Kan. ..... May 20
Jun. 1. Owensboro, Ky. ..... Apr. 22
Jun. 1. Findlay, O. ..... May 13
Jun. 1. Tacoma, Wash. ..... May 13
Jun. 1. Mansfield, O. ..... May 20
Jun. 1. Oxford, N. Y. ..... May 20
Adv. May 20.
Jun. 1. Elmira, N. Y. ..... May 20
Adv. May 20.
Jun. 1. Traverse City, Mich. ..... May 20
Adv. May 20.
Jun. 1. Brooklyn, N. Y. ..... May 20
Jun. 2. Cincinnati, O. ..... May 6
Jun. 5. Cincinnati, O. ..... May 13
Jun. 5. Emporia, Kan. ..... May 20
Jun. 5. Rockville, Ind. ..... May 20
Jun. 5. Antigo, Wis. ..... May 20
Jun. 5. Bedford, Ind. ..... May 20
Jun. 5. Grenada, Miss. ..... May 20
Jun. 6. Waterbury, Conn. ..... May 13
Jun. 6. Indianapolis, Ind. ..... May 13
Jun. 6. Amsterdam, N. Y. ..... May 13
Jun. 7. Flemington, N. J. ..... May 13
Adv. May 13, 20.
Jun. 7. East Cleveland, O. ..... May 20
Jun. 8. Cincinnati, O. ..... May 20
Jun. 10. Wyoming, O. ..... May 20
Jun. 16. Cincinnati, O. ..... May 20
Jun. 19. New Orleans, La. ..... May 13
Adv. May 13, 20.
Jun. —. Council Bluffs, Ia. ..... May 20
Aug. 1. Belvidere, Ill. ..... May 20
Grenada, Miss. ..... Apr. 29

POWER, GAS AND ELECTRICITY.

May 23. Washington, D. C. ..... Apr. 29
May 23. Washington, D. C. ..... May 13
May 26. Kankakee, Ill. ..... May 6
May 29. Sanborn, Minn. ..... May 20
May 31. Washington, D. C. ..... Apr. 29
Adv. Apr. 20 to May 6.
May 31. Washington, D. C. ..... May 13
Jun. 1. Spartanburg, S. C. ..... Apr. 29
Jun. 1. Selingsgrove, Pa. ..... May 20
Jun 3. Cape Charles, Va. ..... Apr. 8
Jun. 5. Visalia, Cal. ..... May 20
Jun. 6. Sebastapol, Cal. ..... Apr. 22
Jun. 6. Shelbyville, Tenn. ..... May 13
Jun. 6. N. Tonawanda, N. Y. ..... May 20
Jun. 8. Newport, Ky. ..... Apr. 29
Jun. 8. Wilmington, N. C. ..... May 20
Jun. 8. Newport, Ky. ..... May 20
Jun. 10. Norfolk, Va. ..... May 20
Jun. 10. Washington, D. C. ..... May 20
Adv. May 20.
Jun. 12. Winnipeg, Man. ..... May 20
Adv. May 20.
Jun. —. Reading, O. ..... May 13

BUILDINGS.

May 23. P. O. Bldg., Owosso, Mich. ..... Apr. 22
May 23. Hospital, Raleigh, N. C. ..... Apr. 29
May 23. School, Cape Girardeau, Mo. ..... May 6
May 23. Schools, Newark, N. J. ..... May 13
May 23. Court house, Manitowoc, Wis. ..... May 13
May 23. Machine shop, Newport, R. I. ..... May 13
May 23. School, Dodgeville, Wis. ..... May 20
May 23. Engine House, Marion, O. ..... May 20
May 23. Pub. Bldg., Buffalo, N. Y. ..... May 20
May 24. P. O. Bldg., Pekin, Ill. ..... Apr. 29
May 24. School, Corydon, Ia. ..... May 6
May 24. Hospital, Jersey City, N. J. ..... May 6
May 24. Plans for school, Peru, Neb. ..... May 20
May 24. School, Kearney, Neb. ..... May 20
May 24. School, Denver, Colo. ..... May 20
May 24. School, Birmingham, Ala. ..... May 20
May 24. School, Cleveland, O. ..... May 20
May 25. P. O. Bldg., Geneva, N. Y. ..... Apr. 22
Adv. Apr. 22, 29.
May 25. Post Bldg., Ft. du Pont, Del. ..... Apr. 29
Adv. Apr. 29 to May 20.
May 25. Post Hosp., Ft. Riley, Kan. ..... Apr. 29
Adv. Apr. 29 to May 20.
May 25. Church, Indianapolis, Ind. ..... May 6
May 25. School, Fairfax, Minn. ..... May 13
May 25. School, Denver, Colo. ..... May 20
May 25. School, Fremont, Mich. ..... May 20
May 25. Pub. Bldgs., New York, N. Y. ..... May 20
May 25. Schools, Louisville, Ky. ..... May 20
May 25. Pub. Bldg., Frankfort, Ky. ..... May 20
May 25. School, Ishpeming, Mich. ..... May 20
May 26. School, Indianapolis, Ind. ..... May 13
May 26. School, Tipton, Ind. ..... May 13
May 26. School, Anamoose, S. D. ..... May 20
May 26. Bus. Bldg., Shelbyville, Ind. ..... May 20
May 26. Court House, Utica, N. Y. ..... May 20
May 27. Post bldgs., Vancouver Bar., Wash. May 6
May 27. Post bldgs., Ft. Ethan Allen, Vt. ..... May 6
Adv. May 6 to 20.
May 27. School, Big Stone Gap, Va. ..... May 13
May 27. School, Dillon, Mont. ..... May 20
May 27. School, Isanti, Minn. ..... May 20
May 27. Hospital, Ft. Sheridan, Ill. ..... May 20
May 29. Htg. P.-O. bldg., Kankakee, Ill. ..... May 6
May 29. Light house, Tompkinsville, N. Y. ..... May 6
May 29. School, Marble Rock, Ia. ..... May 13
May 29. School, Jefferson, Ia. ..... May 13
May 29. Schools, New Brighton, S. I., N. Y. ..... May 20
May 29. Schools, New York, N. Y. ..... May 20
May 29. Schools, Brooklyn, N. Y. ..... May 20
May 29. Pub. Bldg., Chicago, Ill. ..... May 20
May 29. Jail, Lafayette, Tenn. ..... May 20
May 29. Hospital, Philadelphia, Pa. ..... May 20
May 30. Pub. Bldg., Cleveland, O. ..... May 20
May 31. P. O. Bldg., Allentown, Pa. ..... Apr. 29
May 31. Boat house, etc., Philadelphia, Pa. ..... May 6
May 31. Courthouse, Baltimore, Md. ..... May 13
May 31. School, Shiprock, N. M. ..... May 13
May 31. Court house, Darlington, Wis. ..... May 13
May 31. Pub. Bldg., Oklahoma, Okla. Ter. ..... May 20
May 31. Post Bldg., Addition Governor's Island, N. Y. Adv. May 20 ..... May 20
May 31. Post Bldg. work, Ft. Mott, N. J. ..... May 20
Adv. May 20.
May 31. Library stacks, Washington, D. C. ..... May 20
Adv. May 20.
May 31. New York, N. Y. ..... May 20
May 31. Pub. Bldg., New York, N. Y. ..... May 20
May 31. School, Lima, N. Y. ..... May 20
May 31. Pub. Bldg., St. Boniface, Man. ..... May 20
Jun. 1. P. O. Bldg., Little Falls, N. Y. ..... Apr. 29
Adv. May 6 to 20.
Jun. 1. Bank, Knoxville, Tenn. ..... Bay 6
Jun. 1. School, Pine Ridge, S. D. ..... May 13
Jun. 1. School, Huntington, W. Va. ..... May 13
Jun. 1. Church, South Shore, S. D. ..... May 20
Jun. 1. Pub. Bldgs., Lincoln, Neb. ..... May 20
Jun. 1. Pub. Bldg., Chicago, Ill. ..... May 20
Jun. 1. Library, Watertown, S. D. ..... May 20
Jun. 1. Hotel, Hot Springs, Ark. ..... May 20
Jun. 2. Bus. building, Washington, Ind. ..... May 13
Jun. 2. School, Tulalip, Wash. ..... May 13
Jun. 2. School, Girard, O. ..... May 20
Jun. 2. Hospital, Nevada, Mo. ..... May 20
Jun. 2. Church, St. Paul, Minn. ..... May 20
Jun. 3. School, Durham, N. H. ..... May 20
Jun. 3. Pub. Bldg., Washington, D. C. ..... May 20
Jun. 5. Capitol, Frankfort, Ky. ..... Apr. 22
Jun. 5. P. O. Bldg., Crawfordsville, Ind. ..... Apr. 29
Jun. 5. School, Watervliet, N. Y. ..... May 13
Jun. 5. School, Groveport, O. ..... May 13
Jun. 5. School, Lorain, O. ..... May 20
Jun. 5. School, East St. Louis, Ill. ..... May 20
Jun. 5. Post Bldg., Ft. Miley, Cal. ..... May 20
Jun. 5. Pub. Bldg., Buffalo, Wyo. ..... May 20
Jun. 6. P. O. Bldg., Rockhill, S. C. ..... Apr. 29
Jun. 6. School, Wellsville, O. ..... May 20
Jun. 6. School, Orange, N. J. ..... May 20
Jun. 7. P. O. bldg., Reno, Nev. ..... May 6
Jun. 7. Pub. buildings, Honolulu, H. I. ..... May 13
Jun. 7. Magazine, etc., Ft. Mifflin, Pa. ..... May 20
Jun. 8. P.-O. bldg., Amesbury, Mass. ..... May 6
Adv. May 6, 13.
Jun. 8. School, Hilliards, O. ..... May 20
Jun. 8. Post. Bldgs., Ft. Totten, N. Y. ..... May 20
Adv. May 20.
Jun. 8. Library, Union, N. J. ..... May 20
Jun. 10. Schools, Alaska ..... May 6
Jun. 10. Court house, Plaquemine, La. ..... May 6
Adv. May 6 to 20.
Jun. 12. Capitol plans, Boise, Idaho ..... Apr. 22
Jun. 12. School, Cleveland, O. ..... May 20
Jun. 14. Pub. Bldgs., Lawrence, Ind. ..... May 20
Adv. May 20.
Jun. 15. Court House plans, New Orleans, La. ..... Feb. 25
Adv. Apr. 29.
Jun. 15. Synagague plans, Houston, Tex. ..... Apr. 15
Jun. 15. Court House plans, New Orleans, La. Apr. 22
Jun. 15. Pub. bldg., Honolulu, H. I. ..... Apr. 29
Jun. 15. Window screens, etc., at Post, Key West Barracks, Fla. Adv. May 20 ..... May 20
Jun. 15. Boat House, Key West Barracks, Fla. ..... May 20
Adv. May 20.
Jun. 16. Pub. Bldg., Ft. Hancock, N. J. ..... May 20
Adv. May 20.
Jun. 19. P. O. Bldg., Atlantic, Ia. ..... May 20
Jun. 19. School, Grand Rapids, Mich. ..... May 20
Jun. 20. P. O. Bldg., Colorado Springs, Colo. ..... May 20
Adv. May 13, 20
Jun. 21. P. O. Bldg., Winston, N. C. ..... May 20
Jun. —. School plans, Stillwater, Okla. Ter. ..... May 20
Jul. 1. Pub. Bldg., Baltimore, Md. ..... May 20
Jul. 5. Court House plans, Montgomery, Ala. ..... May 20
Jul. 30. Court House improv., Leesville, La. ..... May 13
Aug. 1. Y. M. C. A. Bldg., Spokane, Wash. ..... Apr. 29
Pub. bldg., St. Louis, Mo. ..... May 13

STREET CLEANING AND GARBAGE DISPOSAL.

Jun. 1. Street cleaning, Philadelphia, Pa. ..... May 20

MISCELLANEOUS.

May 23. Supplies, Washington, D. C. ..... Apr. 22
May 23. Breakwater, Block Island, R. I. ..... Apr. 29
Adv. Apr. 29 to May 20.
May 23. Dredging, Block Island, R. I. ..... Apr. 29
Adv. Apr. 29 to May 20.
May 23. Remov. rock, Buzzards Bay, Mass. ..... Apr. 29
Adv. Apr. 29 to May 20.
May 23. R. R. supplies, New Orleans, La. ..... Apr. 29
May 23. Park improv., Cleveland, O. ..... May 13
May 23. Park work, Newark, N. J. ..... May 20
May 23. Revetment, National Soldiers' Home, Va. ..... May 20
May 23. Pub. Bldgs, Buffalo, N. Y. ..... May 20
May 24. Pipe, tools, etc., Panama. Adv. Apr. 29 to May 20 ..... Apr. 29
May 24. Pier, Baltimore, Md. ..... May 6
Adv. May 6 to 20.
May 24. Levee, Varner, Ark. ..... May 13
May 24. Retaining walls, Philadelphia, Pa. ..... May 13
May 25. Levee work, Memphis, Tenn. ..... Apr. 29
Adv. Apr. 29 to May 20.
May 25. Drain, Marion, O. ..... May 6
Adv. May 6.
May 25. R. R. work, Asheville, N. C. ..... May 13
May 25. Removing wreck, Cleveland, O. ..... May 20
May 25. Wharf, New Campbellton, N. S. ..... May 20
May 26. Dredging, Buffalo, N. Y. ..... Apr. 29
Adv. Apr. 29 to May 20.
May 26. Pier, etc., New York, N. Y. ..... May 20
May 27. Lock, etc., Pittsburg, Pa. ..... Apr. 29
Adv. Apr. 29 to May 20.
May 29. Lock gates, etc., Nashville, Tenn. ..... Apr. 29
Adv. Apr. 29 to May 20.
May 29. Excav., Boston, Mass. ..... Apr. 29
Adv. Apr. 29 to May 20.
May 29. Dredging, Portland, Me. ..... May 6
Adv. May 6 to 20.
May 29. Lock, Plaquemine, La. ..... May 6
Adv. May 6 to 20.
May 29. Sea slope, etc., Buffalo, N. Y. ..... May 6
Adv. May 6 to 20.
May 29. Breakwater, Rondeau, Ont. ..... May 20
May 29. Garbage, Bradley Beach, N. J. ..... May 20
May 29. Dredging, etc., New York, N. Y. ..... May 20
May 29. Levee work, Shreveport, La. ..... May 20
May 30. Steel shed, New Orleans, La. ..... May 13
Adv. May 13 to 20.
May 30. Improv. canal, Columbus, O. ..... May 20
May 31. Docks, etc., Cincinnati, O. ..... May 6
May 31. Dredging, Mobile, Ala. ..... May 6
Adv. May 6 to 20.
May 31. Supplies, Washington, D. C. ..... May 13
May 31. Dump carts, etc., Panama ..... May 13
May 31. Pier, Peel Head Bay, Que. ..... May 13
May 31. Levee work, Vicksburg, Miss. ..... May 13
Adv. May 13 to 20.
May 31. Dredge, Galveston, Tex. ..... May 6
Adv. May 13 to 20.
Jun. 1. Telephone system, Glendive, Mont. ..... Apr. 29
Adv. Apr. 29 to May 20.
Jun. 1. Conduit, Boston, Mass. ..... May 20
Adv. May 20.
Jun. 1. Cement, Mansfield, O. ..... May 20
Adv. May 20.
Jun. 2. Channel, Grand Rapids, Mich. ..... May 6
Adv. May 6 to 20.
Jun. 3. Dredging, Norfolk, Va. ..... May 20
Jun. 5. Breakwater, Port Stanley, Ont. ..... May 13
Jun. 5. Timber, Nashville, Tenn. ..... May 6
Jun. 5. Dredging, Cleveland, O. ..... May 13
Jun. 5. Pier work, Port Wing, Wis. ..... May 13
Adv. May 13, 20.
Jun. 5. Dredging, Wilmington, Del. ..... May 13
Adv. May 13, 20.
Jun. 5. Jetties, Ft. Screven, Ga. ..... May 20
Adv. May 20.
Jun. 5. Wharf, etc., Ft. Wood, N. Y. H., N. Y. ..... May 20
Adv. May 20.
Jun. 6. Channel excav., Ogdensburg, N. Y. ..... May 13
Adv. May 13, 20.
Jun. 6. Supplies, Washington, D. C. ..... May 13
Jun. 7. Rostrum, Culpeper, Va. ..... May 13
Adv. May 13, 20.
Jun. 8. Dikes, Augusta, Ga. ..... May 6
Adv. May 6 to 20.
Jun. 8. Jetty work, Cleveland, O. ..... May 13
Adv. May 13, 20.
Jun. 8. Supplies, Wilmington, N. C. ..... May 20
Jun. 8. Canal, Onawa, Iowa ..... May 20
Adv. May 20.
Jun. 10. Iron wk. for lock, Little Rock, Ark. ..... May 13
Adv. May 13, 20.
Jun. 10. Pier, Detroit, Mich. ..... May 13
Adv. May 13, 20.
Jun. 10. Dredging, Wilmington, Del. ..... May 20
Jun. 10. Cement for lock, Little Rock, Ark. ..... May 13
Adv. May 13, 20.
Jun 12. Ditch work, Geneseo, Ill. ..... May 13
Adv. May 13, 20.
Jun. 12. Dredging, Lynn, Mass. ..... May 13
Adv. May 13, 20.
Jun. 13. Pier, Gallipolis, O. ..... May 20
Jun. 13. Pier, Maysville, Ky. ..... May 20
Jun. 14. Bldg. Material, etc., West Point, N. Y. ..... May 20
Adv. May 20.
Jun. 14. Rubblestone, Boston, Mass. ..... May 20
Adv. May 20.
Jun. 14. Tower, Philadelphia, Pa. ..... May 20
Jun. 15. Pole and telephone line, Minidoka, Idaho. Adv. Apr. 22 to May 20 ..... Apr. 22
Jun. 15. Wharf, etc., Honolulu ..... Apr. 20
Jun. 15. Trestles, etc., Louisville, Ky. ..... May 20
Adv. May 20.
Jun. 15. Excav, etc., Panama ..... May 20
Jun. 15. Dredging, Mobile, Ala. ..... May 20
Adv. May 20.
Jun. 15. Remov. wreck, Jacksonville, Fla. ..... May 20
Adv. May 20.
Jun. 20. Searchlight outfit, Washington, D. C. ..... May 20
Adv. May 20.
Jun. 24. El. Ry. franchise, Hollister, Cal. ..... May 20
Jun. —. Dam, Iowa City, Ia. ..... Apr. 22
Jun. —. Subway, Memphis, Tenn. ..... May 13
Jul 1. Municipal St. Ry. system, Chicago, Ill. ..... Apr. 15
Adv. Apr. 15 to May 6.
Aug. 26. Coal plant, Olongapo, P. I. ..... May 6
Sep. 1. Steel and iron, Sydney, N. S. Wales ..... Apr. 22
Adv. Apr. 8, 22, May 6, 20.
Apr. 2, '06. Harbor Work, Valparaiso, Chili ..... Apr. 29
Adv. Apr. 29 to May 20.